AGRICULTURAL RESEARCH INSTITUTE

PUSA

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OF THE

BOARD OF AGRICULTURE

OF

BRITISH GUIANA.

ISSUED QUARTERLY.

VOLUME VII.

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EDITED BY:

ALLEYNE LEECHMAN, F.L.S., F.C.S.,

AND

G. E. BODKIN, B.A., F.Z.S., F.E.S.
(Acting).

Demerara:
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1915.

It is hoped that this action will do much to help in finding a market for new products and developing the market for those already exploited.

Planters and residents in British Guiana are at liberty to send (through the Secretary to the Permanent Exhibition Committee) specimens of little known or new vegetable or mineral products of the colony for examination at the Imperial Institute, by whom a report will be made through the Government Secretary. Specimens should, if possible, consist of a few pounds of the materials, and must be accompanied by full information, especially respecting the precise locality in which the material is found and the extent of its occurrence.

Attention may also be drawn to the "Bulletin of the Imperial Institute," published quarterly, which contains records of the investigations conducted at the Imperial Institute, and special articles on tropical agriculture and the commercial and industrial uses of vegetable and mineral products. Copies of this publication, price 4s. 4d. per annum (including postage), may be ordered through "The Argosy" Company, Limited.

Special sample-rooms have been arranged at the Imperial Institute for the information of inquirers in which materials which have been investigated and valued are available for reference.

Important products of the Colony are shown in the British Guiana Court in the Public Galleries of the Imperial Institute.

SUBSCRIPTIONS TO "THE JOURNAL."

A number of complaints have been received, particularly from the country districts, that would-be readers of "The Journal" are unable to obtain copies. Our system of distribution has been made as complete as possible, but the demand at many centres has so exceeded the supply that some disappointment has been inevitable. We would point out, however, that by the simple method of

SUBSCRIPTION

all inconvenience can be avoided. The sum of

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The Assistant Director of
Science and Agriculture,
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will ensure the delivery of one volume (four numbers) of "The Journal," post free, for one year. This method is earnestly commended to all our readers, present and prospective.

Lands and Mines Notice.

Under Crown Lands Regulations.

NOTICE.

SELLING PRICE OF CROWN LAND.

AS required by Clause 24 of the Crown Lands Regulations, 1910, notice is hereby given that His Excellency the Governor has been pleased to fix the price at which Crown Land in the colony shall ordinarily be sold as follows :—

For areas up to 100 acres at $1.00 per acre.

For each acre over 100 acres and up to 250 acres at 75c. per acre.

For each acre over 250 acres up to 500 acres at 60c. per acre.

These prices to include all costs of Survey and preparation of title, etc.

The Governor, however, reserves to himself the right to make grants of land in excess of 500 acres on special conditions as to purchase, in cases where the applicants can advance satisfactory proof as to the capital to be invested and their ability to beneficially occupy the land.

FRANK FOWLER,
Commissioner of Lands and Mines,

Department of Lands and Mines
1st April, 1910.

Terms and Conditions on which Crown Lands in British Guiana can be obtained for the Cultivation of Rubber under the Crown Lands Regulations, 1910.

(1.) The Governor may grant leases of areas of land of any size for the purpose of cultivating rubber thereon for a term of ninety-nine years subject to the following terms and conditions:—

(*a.*) No rent shall be payable during the first ten years of the lease but the lessee shall pay an annual rent of twenty cents an acre from the eleventh to the fifteenth year inclusive, and an annual rent of fifty cents an acre during the remainder of the lease, and in default of payment of such rent on the day on which the same is due, the lessee shall in addition pay interest thereon at the rate of six per centum per annum for each day of such default.

(*b.*) During the first ten years of the lease the lessee shall pay the sum of two cents a pound for all rubber, balata, or other substances of the like nature obtained by him from the land, whether from indigenous or cultivated trees.

(*c.*) The lessee shall each year plant one-twenty-fifth part of the land leased with rubber trees, with an average of not less than sixty rubber trees to each acre, until he has so planted not less than ten-twenty-fifth parts of the said land and shall maintain such cultivation in good order to the satisfaction of the Governor-in-Council.

(*d.*) In clearing the said land for cultivation no rubber tree or bullet tree shall be destroyed without the permission in writing of the Commissioner.

(*e.*) The lessee shall not transfer his interest in the land leased or any part thereof, save with the permission of the Governor-in-Council, but such permission shall not be unreasonably withheld.

(*f.*) If the lessee employs Aboriginal Indians, he shall keep on the tract a book, which shall be open at all times to the inspection of the Protector of Indians, the Magistrate of the District, and of any officer of the Department, Commissary of Taxation, or Officer of the Police Force and in which shall be regularly entered the name and tribe of every such Aboriginal Indian, the rate of wages allowed, and the amount paid; and all such wages shall be paid in money except with the sanction in writing (which may be either special or general) of the Protector of Indians and shall be paid (as the labourer may desire) either weekly or at the expiration of his contract, or part weekly and the remainder at the expiration of his contract;

(*g.*) The lessee shall not give or deliver to any Aboriginal Indian any spirituous liquor as an equivalent for, or in payment of, wages or for any work or labour done or performed for him by such Aboriginal Indian.

h.) The lessee shall place and keep on the façade of the land leased on or near to each boundary paal, a board or tablet on which shall be painted in plain legible letters and figures the name of the lessee, the length of the façade the compass bearings and depth of the side-lines of the

land, and the number and date of the lease under which he holds it; and the lessee shall keep such board or tablet with such inscription in good repair during the continuance of the lease; and he shall also keep the boundary lines of the land so far as he has cultivated or beneficially occupied it clear and open at all times to the inspection and reasonable satisfaction of any officer of the Department of Lands and Mines.

(*i.*) The land leased shall be subject to the right of way across any portion of it to the Crown lands aback of the said land for the officers and servants of the Crown and Government of the Colony and others thereto authorized by the Crown or Government.

(*j.*) The ease shall not confer on the holder any right to take or obtain mineral oil from any deposit that may exist in or under the land leased and all officers of the Crown or Government and other persons thereto specially authorized by the Government shall at all times have the right to enter such lands for the purpose of obtaining mineral oil therefrom: provided that the lessee shall have the right to compensation for any damage suffered by him in consequence of such entry and the obtaining of mineral oil from the said lands.

(*k.*) If the lessee pays the rent reserved and observes and performs all the covenants and conditions contained in the lease, he shall and may peaceably and quietly possess and enjoy the land leased without any interruption by the Crown or any person lawfully or equitably claiming from or under the Crown.

(2.) If any of the said terms and conditions are not complied with, or the rent is not paid, within fifteen days of the same becoming due, the Commissioner shall have the right to re-enter the land leased and take possession of the same, without paying compensation for buildings or machinery erected by the lessee on the said land.

(3.) If all the terms and conditions of the lease have been complied with, the lessee shall have the right, at any time after the expiration of ten years from the date of the lease, to purchase the land leased at the price of four dollars an acre, and on payment of the said price an absolute grant of the said land shall be made to him, and from the date of such grant the said land shall without exception be in the same position and subject to the same laws and regulations as private lands.

(4.) The fees payable for obtaining a lease, which must be deposited with the application are as follows:

	$ c.
Application	5 00
Survey—	
Areas up to 500 acres—per acre ..	30
Each acre above 500 and up to 1,000	20
Each acre above 1,000	10
These charges include labour, cutting lines, etc.	
Cost of drawing up, executing and stamping lease in Registrar's Office, say	16 20

DEPARTMENT OF SCIENCE AND AGRICULTURE.

Directions to Correspondents.

Notice.—Letters should preferably be written on one side of the paper only, and as far as possible, each letter should deal with one subject only, to allow of its being referred to the officer who is concerned with the subject.

Officers should be addressed by their titles, not by their names, to prevent confusion with private letters and to ensure that official letters are opened in their absence.

Letters should be addressed—according to the nature of their contents and the business dealt with —to either

The Director,
Department of Science and Agriculture,
Broad Street,
Georgetown.

or

The Government Botanist,
The Botanic Gardens,
Georgetown.

If intended for

The Editor,
The Journal of the Board of Agriculture,

or The Economic Biologist.

or The Secretary of the Board of Agriculture, letters should be sent to

Broad Street,
Georgetown.

Parcels should always contain the name of the sender If this is not done, it is often impossible to tell from whom they come, in the case of several arriving at the same time.

DEPARTMENT OF SCIENCE AND AGRICULTURE, BRITISH GUIANA.

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The Natural History Club.

For several years past the desirability of establishing a Field and Natural History Club in British Guiana has impressed itself on those who have been watching events and men and things in the Colony. Compared with twenty-five years ago, remarkably little interest is now taken by the public generally in local Botany, Zoology or Geology, and in this unfortunate fact many thinking minds have seen one of the reasons for the very slow rate of development of the Colony.

With a view to remedying, as far as possible, this state of affairs, the proposal was put forward that a Field and Natural History Society should be formed. The approval and interest of His Excellency the Governor were secured; a circular was drafted and sent to those who, it was felt, might be attracted; and permission was obtained to use the Board Room of the Board of Agriculture and the Herbarium and Botanical Laboratory of the Department of Science and Agriculture for the purposes of the proposed Club. The response to the circulars was satisfactory and showed that a real interest in the subject existed among those whose co-operation was especially desired. Several valuable hints and suggestions, too, came from those approached, and the desire that the youngsters might take a prominent part in the active work of the Club was expressed by more than one correspondent. This aspect of the question has already been alluded to in our articles on "Science as a

School Subject in British Guiana," but it is encouraging to find others as convinced as we are of the importance of Nature Study (in its real sense) as a means of education for the youth of the Colony.

It only remains to organize the Club on a practical basis. This will necessarily take some little time, but already problems have arisen which it would be the function of such a Society to attempt to solve. We have recently been in receipt, from eminent authorities in England, of several questions on important points in Natural History, and it has been with immense regret that we have recognized the impossibility, owing to lack of reliable observers, of supplying anything in the nature of a satisfactory reply.

Some of our readers may have heard of Joseph Leidy, the contemporary of Louis Agassiz and one of the pioneers of real Nature Study in the United States of America. As was justly said of him by Prof. Minot, he was a *naturalist*, a type of scientific man which seems, in these days of specialization, almost extinct. He saw Nature as a whole made up of many parts, and he was interested in the whole drama. His delight was to go forth and see the world and watch the co-ordinated working of its parts. The correlation between living beings and physical forces appealed to him. He was quite untouched by the "laboratory spirit" which isolates an object or phenomenon indoors in order to apply to it all the finest resources of modern scientific equipment. He, on the contrary, went out of doors to see and study, and the spoils he brought home were investigated without any elaborate appliances. Young zoologists, botanists and geologists of to-day find these methods too toilsome. Leidy studied the living fauna of the streams and ponds with a simple microscope such as even the elementary students of to-day would scarce deign to use, yet how varied, interesting and wonderful were the observations he recorded. He searched all sorts of animals—insects, vertebrates, molluscs—and found a great number of parasitic plants and animals, and many of these were new to Science. To-day his statue stands by the great City Hall of Philadelphia and his name is associated with the University's highest work. His opinion of Nature Study is consequently of value and we give it here:—"The study of natural history in the leisure of my life, since I was fourteen years of age, has been to me a constant source of happiness; and my experience

of it is such that independently of its higher merits, I warmly recommend it as a pastime, which I believe no other can excel. At the same time, in observing the modes of life of those around me it has been a matter of unceasing regret that so few, so very few, people give attention to intellectual pursuits of any kind. In the incessant and necessary struggle for bread we repeatedly hear the expression that "man shall not live by bread alone," and yet it remains unappreciated by the mass of even so-called enlightened humanity. In common with all other animals, the engrossing care of man is food for the stomach, while intellectual food too often remains unknown, is disregarded, or rejected." Had Joseph Leidy been alive to-day he might well have amended his quotation to "Man shall not live for Bridge alone."

A Warning: Buy Pure Copper Sulphate.

The Board of Agriculture and Fisheries again desire to impress upon agriculturists and others the importance of securing pure copper sulphate when purchasing "blue vitriol" for agricultual purposes. The Board continue to receive evidence that impure copper sulphate is sold freely to persons who desire to purchase blue vitriol, the most common adulterant being sulphate of iron (green vitriol), which is often present in large quantities, the mixture being artificially coloured to resemble copper sulphate. An Inspector of the Board recently purchased samples of "blue vitriol for wheat dressing," which, upon analysis, showed an average content of 12.5 per cent. of "blue vitriol" only, the remainder of the substance being green vitriol coloured with Prussian blue.

It should be borne in mind that the value of the material sold in these cases is practically in proportion to the amount of sulphate of copper present, and iron sulphate can only be regarded as an adulterant. It is advisable, therefore, in obtaining sulphate of copper to demand from the seller a guarantee of 98 per cent. purity, and to avoid purchasing the article sold as "agricultural" sulphate of copper.

The presence of iron in copper sulphate may be determined readily by dissolving a small amonnt in water and adding ammonia, the solution being constantly stirred till a deep blue liquid is formed. Any quantity of brown flecks floating in this blue liquid indicates the presence of so much iron that the copper sulphate should be subjected to a proper analysis before use.

—"The Journal of the Board of Agriculture" (England),
May, 1913.

The Crops on the Experimental Sugar-Cane Fields, 1912.

By Professor J. B. Harrison, M.A., C.M.G., Director of Science and Agriculture, and R. Ward, Agricultural Superintendent.

THE crops grown on the Experimental Sugar-Cane Fields were reaped in December, 1912. The general results of these crops are shown in the following notes :—

THE RAINFALL, 1912.

The rainfall during this disastrous year as recorded at the Experimental Fields, the average monthly rainfalls on them during the eleven years 1900–1911, and the differences of the rainfalls during 1912 in excess of or in deficit from the average monthly rainfalls, are shown by the following :—

	1912.	*Averages 11 years 1910-1911.*	*Difference from Averages.*
	Inches.	*Inches.*	*Inches.*
January ...	0.82	8.82	− 8.00
February ...	.69	6.26	− 5.57
March ...	.99	9.68	− 8.69
April ...	6.78	7.65	− .87
May ...	7.88	11.80	− 3.92
June ...	7.91	11.86	− 3.95
July ...	10.80	9.58	+ 1.22
August ...	5.66	7.29	− 1.63
September ...	1.29	3.48	− 2.19
October ...	2.09	2.41	− .32
November ...	4.73	5.04	− .58
December ...	12.58	10.65	+ 1.93
Total ...	62.22	94.52	−32.30

The year was characterised by a period of intense drought in the months of January, February and March and the first three weeks of April. From then to the end of the year with the exception of the months of July and December the monthly

rainfalls were lower than the averages so that from August to December the sugar-cane suffered from insufficient rainfall and the plants already stunted and otherwise materially weakened by the prolonged drought in the early part of the year were unable to fully recover their vigour or to attain to a condition of satisfactory maturation.

It was not possible to reap, as is usually done, any of the varieties of sugar-canes in May or June the rainfalls from the 12 months preceding May 1912, having been as follows :—

	1911.	*Averages 10 Years.*	*Difference from Averages.*
May 1911 ...	9.96	11.99	– 2.03
June ,, ...	10.19	12.05	– 1.84
July ,, ...	9.54	9.69	– .15
August ...	3.35	7.69	– 4.34
September ...	.38	3.79	– 3.41
October ...	2.07	2.45	– .38
November ...	2.35	5.31	– 2.96
December ...	2.20	11.49	– 9.29
1912.		*11 Years.*	
January ...	.82	8.82	– 8.00
February ...	.69	6.26	– 5 57
March ...	.99	9.68	– 8.69
April ...	6.78	7.65	– .87
Total ...	49.32	99.85	–50.53

This deficiency amounting to 50.6 per cent. of the normal rainfall resulted in a complete cessation of growth among nearly all of the sugar-canes planted on the Experimental Fields. D 145 and D 118 were well-marked exceptions to this.

YIELDS OF VARIETIES.

The yields of the varieties may be conveniently compared with those of Bourbon canes growing on land which had not been under Bourbon for several years. The average yields and characteristics of the expressed juices of the varieties under the

various conditions of manuring used in the large plot series of trials were as follows :—

Variety.	*Tons Canes per acre.*	Juice. *Per cent. of canes.*	Juice. *Specific Gravity.*	Saccharose in Juice. *Lbs. per gallon.*	Saccharose in Juice. *Tons per acre.*
D 145	26.9	68.7	1.079	1.831	3.14
D 118	26.7	70.6	1.0732	1.696	2.98
D 419	24.8	67.6	1.0736	1.668	2.60
Bourbon	22.5	72.8	1.0735	1.694	2.58
D 167	22.2	69.2	1.0722	1.584	2.27
D 721	24.0	66.9	1.0652	1.461	2.20
D 317	23.1	66.9	1.068	1.464	2.12
D 651	19.2	70.0	1.0692	1.542	1.94
D 420	18.4	66.1	1.069	1.553	1.77
D 642	16.5	72.3	1.0666	1.520	1.74
D 454	16.2	67.7	1.077	1.703	1.73
D 246	17.1	67.9	1.0756	1.594	1.72
D 58	15.7	64.3	1.0752	1.734	1.67
D 625	17.6	67.7	1.069	1.492	1.66
D 294	14.3	70.6	1.0781	1.775	1.66
D 338	15.0	72.6	1.0704	1.614	1.64
D 293	14.5	69.3	1.0675	1.687	1.59
D 44	18.2	63.8	1.0674	1.454	1.58
D 216	14.9	69.6	1.0714	1.560	1.51
D 604	14.1	66.1	1.078	1.744	1.51
D 405	17.6	64.6	1.068	1.414	1.50
D 638	16.6	70.3	1.0606	1.337	1.47
D 333	15.9	64.8	1.0676	1.525	1 47
D 177	13.9	68.8	1.075	1.623	1.44
D 4399	14.8	70.3	1.0696	1.486	1.40
D 504	14.6	64.0	1.0728	1.579	1.38
D 76	10.4	68.0	1.072	1.537	1.32
D 154	12.1	62.7	1.064	1.438	1.26
D 281	11.0	68.9	1 0736	1.671	1.18
D 426	11.9	66.6	1.071	1.552	1.15
D 305	11.9	68.2	1.065	1.506	1.14
D 4397	13.5	69.4	1 060	1.269	1.12
D 76	10.4	68.0	1.072	1.539	1.01
D 4407	10.9	69.6	1.065	1.386	.99
D 357	9.8	71.4	1.0668	1.496	.98

(Continued.)

Variety.	Tons Canes per acre.	Juice. Per cent. of canes.	Juice. Specific Gravity.	Saccharose in Juice. Lbs. per gallon.	Saccharose in Juice. Tons per acre.
D 335	11.0	66.6	1.071	1.552	.98
D 139	10.1	69.0	1.065	1.430	.93
D 4395	10.2	66.0	1.0645	1.357	.86
D 433	9.1	68.5	1.0665	1.269	.74
D 398	7.2	68.0	1.072	1.557	.71

Of more direct interest to planters are the relative yields of the varieties under what may be considered as normal nitrogenous manuring for British Guiana—300 lbs. of sulphate of ammonia per acre :—

VARIETIES : YIELDS, ETC., UNDER NORMAL MANURING.

Variety.	Tons Canes per acre.	Juice. Per cent. of canes.	Juice. Specific Gravity.	Saccharose in Juice. Lbs. per gallon.	Saccharose in Juice. Tons per acre.
118	27.3	70.8	1.078	1.703	3.06
Bourbon	25.5	72.8	1.0735	1.694	2.99
D 145	24.1	86.7	1 079	1.831	2.81
D 419	26.4	67.6	1.074	1.667	2.77
D 721	26.6	66.8	1.0692	1.472	2.44
D 167	22.5	68.9	1.0725	1.590	2.39
D 293	20.2	70.2	1.0725	1.636	2.17
D 317	23.4	66.9	1.068	1.464	2.15
D 651	21.5	69.8	1.068	1.506	2.10
D 246	19.5	69.5	1.076	1.594	2.01
D 58	18.8	63.1	1.076	1.737	1.96
D 625	19.7	67.4	1.070	1.516	1.89
D 333	16.2	63.9	1.067	1.537	1.88
D 338	17.0	72.5	1.071	1.605	1.85
D 294	15.8	70.8	1.0783	1.777	1.84
D 624	17.4	72.7	1.068	1.516	1.79
D 504	18.7	64.4	1.0733	1.598	1.79
D 405	20.6	64.6	1.068	1.414	1.76
D 216	16.9	70.3	1.0171	1.566	1.73
D 604	15.9	66.1	1.0773	1.750	1.71

VARIETIES : YIELDS, ETC., UNDER NORMAL MANURING.

(Continued).

Variety.	Tons Canes per acre.	Juice.		Saccharose in Juice.	
		Per cent. of canes.	Specific Gravity.	Lbs. per gallon.	Tons per acre.
D 44	19.7	63.2	1.067	1.443	1.68
D 420	17.0	66.1	1.069	1.553	1.63
D 4399	16.5	70.3	1.0695	1.483	1.62
D 454	15.1	67.8	1.078	1.712	1.62
D 638	18.4	70.4	1.060	1.313	1.60
D 305	16.5	68.2	1.065	1.506	1.59
D 76	15.8	68.3	1.072	1.546	1.59
D 177	14.2	68.8	1.075	1.623	1.47
D 426	14.9	66.6	1.071	1.552	1.44
D 281	12.8	68.7	1.0733	1.707	1.39
D 335	14.3	69.3	1.067	1.389	1.29
D 139	12.3	69.6	1.065	1.438	1.15
D 377	11.0	71.6	1.0673	1.513	1.11
D 4397	12.8	69.4	1.060	1.269	1.06
D 4395	11.3	66.9	1.0656	1.377	.98
D 154	10.7	66.6	1.065	1.464	.98
D 398	9.6	68.0	1.072	1.557	.95
D 4407	8.8	69 6.	1.065	1.386	.89
D 433	9.0	68.5	1.0665	1.269	.73

AVERAGE FOR PLANT-CANES.

The following records the yields of the varieties which were cultivated as plant-canes :—

Variety.	Mean Results.		Yields under Normal Manuring.	
	Canes.	Saccharose.	Canes.	Saccharose.
D 118	32.0	3.64	32.9	3.74
Bourbon	22.5	2.20	25.5	2.99
D 625	13.3	1.16	15.2	1.35
D 4399	13.5	1.12	12.8	1.06
D 398	7.2	.71	9.6	.95
D 4407	10.9	.99	8.8	.89
D 433	9.1	.74	9.0	.73

AVERAGE FOR RATOON CANES.

Yields of Canes and of Saccharose in their Juices.

TONS PER ACRE.

	Mean Results.		Yields under Normal Manuring.	
Variety.	*Canes.*	*Saccharose.*	*Canes.*	*Saccharose.*
D 145	26.9	3.14	24.1	2.81
D 118	24.0	2.63	24.6	2.72
D 419	24.8	2.60	26.4	2.77
D 167	22.2	2.27	22.5	2.39
D 721	24.0	2.20	26.6	2.44
D 317	23.1	2.12	23.4	2.15
D 651	19.2	1.94	21.5	2 10
D 625	19.8	1.70	21.9	2.17
D 420	18.4	1.77	17.0	1.63
D 642	16.5	1.74	17.4	1.79
D 454	16 2	1.73	15.1	1.62
D 246	17.1	1 72	19.5	2.01
D 58	15.7	1.67	18.8	1.96
D 294	14.3	1.66	15.8	1.84
D 338	15.0	1.64	17.0	1.85
D 293	14.5	1.59	20.2	2.17
D 44	18.2	1.58	19 7	1.68
D 216	14.9	1.51	16.9	1.73
D 604	14.1	1.51	15.9	1 71
D 405	17.6	1.50	20.6	1.76
D 638	16.6	1.47	18.4	1.60
D 333	15.9	1.47	16.2	1.88
D 177	13.9	1.44	14.2	1.47
D 4399	14.3	1.40	16.5	1.62
D 504	14.6	1.38	18.7	1.79
D 76	10.4	1.32	15.8	1.57
D 154	12.1	1.26	10.7	.98
D 281	11.0	1.18	12.8	1.39
D 426	11.9	1.15	14.9	1.44
D 305	11.9	1.14	16.5	1.59
D 76	10.4	1.01	15.8	1.57
D 357	9.8	.98	11.0	1.11
D 335	11.0	.98	14.3	1.29
D 139	10.1	.93	12.3	1.15
D 4395	10.2	.86	11.1	.98

As in 1910 and 1911 the results of growing under identical conditions of manuring D 625 in rows six feet and five feet apart respectively were of interest. The mean results were :—

6 feet rows ... 13 tons of canes per acre.
5 feet rows ... 15 tons of canes per acre.

It is clearly advisable on the heavy soil of the Experimental cane-fields to plant canes in rows five feet apart rather than 6 feet.

D 118 as in 1910 and 1911 gave satisfactory results. On the soil of the Experimental fields it has proved to be a cane of high resistent power to drought resembling in this respect D145.

EFFECTS OF MANURING.

NITROGENOUS MANURES.

The beneficial effects of these manures were clearly apparent with all the varieties under trial. The mean returns with normal and high manurings—300 and 450 lbs. of sulphate of ammonia respectively—were as follows : —

		Tons of Canes per acre.		
Fields.	*Canes.*	*No Nitrogen*	*Normal Nitrogen. (60lbs.)*	*High Nitrogen. (90lbs.)*
North-West	Ratoons	15.2	20.7	
South	Plants	20.0	28.0	28.6
,,	Ratoons	10.7	16.2	17.5
North East	Plants	7.8	11.2	12.8
,,	Ratoons	13.2	18.9	20.7
Means of S. & N. E. Fields	Plants	13.9	19.6	20.7
	Ratoons	11.9	17.6	19.1

In 1912 the rainfall during the first four months of the year was deficient for the growth of plant-canes, and to them proved more or less disastrous in the earlier stages of their growth. This ended with the coming on of the rains near the middle of April and was followed by not altogether satisfactory weather during the latter months of the year.

Owing to the above mentioned meteorological conditions during the year, many varieties of canes, especially those growing as plant-canes, were unable to make full use of the

heavy dressings of nitrogen. Their periods of active growth after the cessation of the drought enabled them, as will be seen by the above averages, to make use of manurings equivalent to 300 lbs. of sulphate of ammonia per acre, but were either not long enough or not under sufficiently favourable conditions to enable them to utilise the higher quantities.

VARIOUS SOURCES OF NITROGEN.

The comparison of the action of nitrate of soda and of sulphate of ammonia applied in equivalent proportions of Nitrogen—60 lbs. per acre—gave the following mean results :—

	Tons of Canes per acre.		
Fields.	*No Nitrogen.*	*Nitrate of Soda.*	*Sulphate of Ammonia.*
South	20.3	33.6	27.5
North-East	9.9	14.6	14.7
North-West	15.7	20.0	20.7
Means	15.3	22.7	21.0

Generally in former years the manurial value of the nitrogen in nitrate of soda proved to be somewhat lower than its value in sulphate of ammonia, whilst in several years it was much lower. This was largely due to the trials being on very heavy clay land and to the prevailing meteorological conditions—usually more orless continuous rainy weather soon after their application proving more unfavourable to the dressings of nitrate of soda than to those of sulphate of ammonia. In 1912 the contrary has been the case, the nitrate in two series of the trials having given practically similar results to the sulphate of ammonia whilst in the third series its results were uniformly far more satisfactory than were those of sulphate of ammonia. In that series the manures were applied immediately before the first commencement of the April rains, in the other two series it was not feasible to apply them until the wet weather had well set in. The quicker action of the nitrate in the still comparatively dry soil of the series on South Field resulted in largely increased returns.

The comparisons on South Field as to the relative action of nitrate of soda and of sulphate of ammonia in soils for some

years continuously manured with these substances were as follows :—

	Tons of Canes per acre.	
	After Nitrate of Soda.	*After Sulphate of Ammonia.*
Nitrate of soda ...	34.0	32.2
Sulphate of ammonia	26.7	27.6
	30.35	30.4

It is very evident that the immediate availability of the nitrogen in the nitrate of soda had the effect of causing that manure to give more favourable results under both conditions than did sulphate of ammonia.

Comparisons of sulphate of ammonia, nitrate of soda, nitrate of lime and nitrolim (calcium cyanamide) as sources of nitrogen, when applied in repeated dressings and in proportions in each case equivalent to 60 lbs. of nitrogen per acre, were made on the North-West field with the following results :—

(*a.*) Comparisons of sulphate of ammonia, nitrate of lime, and nitrolim ; mean results with 10 varieties of canes each in duplicate and triplicate plots :—

Tons of Canes per Acre.			
No Nitrogen.	*Sulphate of Ammonia.*	*Nitrate of Lime.*	*Nitrolim.*
14.9	20.7	21.1	19.0

(*b.*) Comparisons of sulphate of ammonia, nitrate of lime, nitrolim and nitrate of soda ; mean results with 6 varieties of canes each in duplicate and triplicate plots.

Tons of Canes per Acre.				
No Nitrogen.	*Sulphate of Ammonia*	*Nitrate of Lime.*	*Nitrolim.*	*Nitrate of Soda.*
15.7	20.7	21.6	19.0	20.0

These comparative trials have been made during three years only, in two of which years the meteorological conditions were very unfavourable to the action of nitrates. The results indicate that in years during which the soil is in a state of

constant saturation due to heavy and persistent rainfalls immediately after the application of the manures, nitrate of soda and nitrate of lime are inferior in their manurial effects to sulphate of ammonia, and that in years when the soil is comparatively dry at the time of application of the manures, and when only moderate rainfalls occur after their application, nitrate of lime may be equal or even a little superior to sulphate of ammonia or nitrate of soda in its action whilst there may be only little difference between the effects of nitrate of soda and sulphate of ammonia. On the other hand the results given by nitrolim have consistently been inferior to those due to the other nitrogenous manures.

NITROGEN WITH POTASH AND PHOSPHATES.

For some years past data have been accumulated pointing to a possible injurious action of excess of soluble salts in the manures applied to cane cultivation on heavy clay soils. In connection with this the following mean results of trials of sulphate of ammonia without and with sulphate of potash and superphosphate of lime will be of interest :—

	Tons of Canes per Acre.			
		Sulphate of Ammonia.		
	No Nitrogen.	*200 lbs.*	*400 lbs.*	*500 lbs.*
Without potash and superphosphates	19.5	23.9	25.8	28.9
With potash and superphosphates	21.1	28.7	34.3	28.3

These indicate the following as the gains due to the nitrogenous manurings :—

	Tons of Canes per Acre.		
	200 lbs.	*400 lbs.*	*500 lbs.*
Without potash and superphosphates	4.4	6.3	9.4
With potash and superphosphates	7.6	13.2	7.2

It is evident that in a year where rapidity of action appears to have been largely the quality dominating the effects of manure the addition of sulphate of potash and superphos-

phate of lime to the manurings of sulphate of ammonia has been advantageous.

EFFECTS OF MANURING WITH PHOSPHATES.

A very large number—upwards of 140—of comparative trials with 29 varieties of sugar cane with and without superphosphate of lime were made. In the majority of these trials increases ensued on the application of phosphates. The mean results are as follows :—

South Field.	Tons of Canes per Acre.	
Ratoons.	*No Phosphates.*	*Superphosphates.*
Plots without Nitrogen	9.3	11.1
Plots with Nitrogen	16.4	16.3

North-East Field. 1st Series.		
Plots without Nitrogen	9.6	11.2
Plots with Nitrogen	15.0	15.7

North-East Field. 2nd Series.	*No Phosphates.*	*Super-phosphate.*	*Slag-phosphates.*
Plots without Nitrogen	12.1	12.6	15.2
Plots with Nitrogen	18.3	18.2	18.7

The general results of application of superphosphate with the varieties used were as follows :—

	No. of Varieties giving	
	Increased Returns.	*No Increase.*
Without Sulphate of ammonia	22	7
With Sulphate of Ammonia	16	13

Five varieties were used with slag-phosphate: the returns from them by application of the slag-phosphate were attended by increased yields, whilst in two no advantage accrued.

The increases due to manurings with phosphates were not remunerative.

The results of these trials may be arranged so as to show the action of the superphosphate of lime on plant-canes and

its residual action on ratoons thus :--

	Plant Canes.		Ratoon Canes.	
	Without Super-phosphate.	*With Super-phosphate.*	*Without Super-phosphate.*	*With Super-phosphate.*
Without sulphate of ammonia	6.9	8.7	12.5	13.4
With sulphate of ammonia	11.6	12.0	18.6	19.1

It is evident that neither the direct application of superphosphate of lime to plant-canes or the residual effects of such applications on ratoons canes can be regarded as remunerative.

THE SUGAR CONTENT OF THE JUICES OF VARIETIES OF SUGAR-CANES AND OF NEW KINDS RAISED FROM THEM.

The following shows the mean content of saccharose in the juices of the Bourbon canes and of 14 varieties raised from its seed as determined in 1911 and 1912 in the large field experiments .—

SUGAR CONTENT OF THE JUICES OF THE BOURBON AND ITS SEEDLINGS.

Saccharose : Lbs. per gallon.

	1911	*1912*	*Mean.*
Bourbon	1.854	1.694	1.774
D 604	2.060	1.744	1.902
D 281	1.862	1.671	1.767
D 338	1.856	1.614	1.735
D 651	1.901	1.542	1.722
D 293	1.710	1.687	1.699
D 216	1.804	1.560	1.682
D 642	1.784	1.520	1.652
D 305	1.792	1.506	1.649
D 4399	1.708	1.486	1.597
D 638	1.856	1.337	1.597
D 721	1.712	1.461	1.587
D 317	1.700	1.464	1.582
D 5495	1.611	1.357	1.482
4397	1.520	1.269	1.394

One of the seedling varieties yielded juice distinctly richer in saccharose than was that of the Bourbon, the juice of another was practically similar to it, whilst the juices of twelve of them were distinctly lower in saccharose than was that of the parent kind.

In the case of D 625 and varieties obtained from its seed, the results were :—

RELATIVE CONTENTS OF D 625 AND ITS SEEDLINGS.

	Saccharose : Lbs. per gallon.		
	1911	*1912*	*Mean.*
D 625	1.735	1.492	1.614
D 419	1.913	1.668	1.790
D 118	1.855	1.696	1.776
D 167	1.854	1.584	1.719
D 333	1.833	1.525	1.679
D 420	1.709	1.553	1.631
D 44	1.765	1.454	1.616
D 76	1.659	1.537	1.598
D 335	1.577	1.552	1.564
D 405	1.662	1.414	1.538

Here the juices of four of the seedling varieties were distinctly richer in saccharose than was the juice of the parent cane D 625, whilst two were nearly similar in strength.

THE PREVALENCE OF DISEASE AMONG THE VARIETIES.

During the crop of 1912 very little disease was noticed on any of the varieties.

A Tribute to Medical Science in British Guiana.

A British Guiana medical report shows that on the Providence Plantation the death rate of East Indians was 16.9 per thousand and the birth rate 35.3. This excellent result shows what can be achieved by the curative and preventive treatment of ankylostomiasis and malaria, the two main causes of sickness and death among the plantation coolies. An efficient system for the disposal of night soil to a great extent prevented re-infection with the former disease, and very satisfactory results were obtained from the use of thymol, which, when continued for many weeks, cured the disease completely without producing any ill effects. A thymol pulverette, coated with chocolate, is obtainable.

—The "Colonial Office Journal," April, 1913.

Some Notes on the Tapping of the Plantation Para Rubber Tree.

By C. K. Bancroft, M.A., F.L.S., Government Botanist.

In view of the commencement of tapping operations on a small scale on some properties in this colony and the prospects of bringing larger areas into bearing in the near future, the following notes are written on the tapping of the plantation rubber tree of the East.

Our knowledge of tapping methods has so far increased within recent years that it is scarcely possible in an article of this nature to do more than indicate for the guidance of growers in this colony some of the more important conclusions which have been arrived at, and to summarise the present methods which are employed on the better plantations in obtaining the latex from the tree.

The cost of tapping and collecting amounts to nearly 50% of the total cost of production of a pound of dry rubber—a factor which alone should make it one of the primary considerations in the management of any estate.

The object to be attained in successful tapping should be to get as much latex as possible from the tree at a minimum of cost with a conveniently small amount of removal of bark and without unnecessarily impairing the health of the tree, so that it may continue to yield for a long period of time. The subject will, therefore, be considered in this article with these points in view.

ORGANISATION.

It is essential for successful tapping that the estate should be properly divided into blocks of approximately equal size—blocks of 20 acres are convenient to work on—the trees planted in definite lines and a definite area allotted to a section of the tapping force under proper supervision. The records of daily yields from each section are to be kept so that any diminution of yield may be easily observed and the reason for it ascertained. A clean area is required to work on; since a coolie is required in ordinary circumstances to make 1,000 cuts a day he must not be hindered by the presence of catch-crops or inter-crops and the smaller the quantity of felled

timber on the land the better. Catch-crops are almost universally condemned in Malaya—although coffee is common among rubber in Sumatra. These crops are only temporary and are scarcely allowed to remain when the rubber has reached tapping age. Permanent inter-crops are more strongly condemned, the worst combination, perhaps, being Para rubber and coconuts.

MODES OF TAPPING.

The first methods employed in tapping the trees in the East appear to have been the ruthless slashing at the bark with axes and cutlasses. Smaller cuts and the use of the pricker succeeded this, and finally, the method now in use of paring away the bark was introduced ; by this the latex is derived by excision as opposed to incision. The general effect of the old methods of tapping was the production of an irregular surface of the bark either by the growth direct of the wood from within or by the origin of solid cores of wood, burrs, in the bark and their ultimate fusion with the central wood of the stem, so as to render the trees unfit for future use. The general effect of cutting too deeply, a practice known as " bad tapping," is the production of a rough surface which interferes with or entirely prevents further tapping on the same surface. For this reason the use of the pricker was discontinued. It is now generally accepted that the best tapping attains a depth which approximates to but does not expose the thin delicate layer known as the cambium which separates the wood and bark.

TAPPING SYSTEM.

By this is meant the manner in which the tree is divided for paring the bark at intervals of one day or more. The requirements of a suitable tapping system are to allow of no less than a nominal time for removal of the bark before the same surface is retapped, and to give a maximum of yield. With this in view, the circumference of the tree is marked out for tapping. The circumference of the tree is measured at each point at which a cut is to be made and this divided into one-half or one-quarter, depending on the horizontal length of the cut. The slope of the cut is estimated, and this must be accurately done ; it must not be too steep, but it must possess an appreciable slope. It must be just steep enough to allow of a good flow of latex without the accumulation of an excessive amount of scrap, *i.e.* the rubber produced by coagulation of the

latex in the cut. An angle of 15 degrees is sufficient for the slope; if it is greater a large triangular area of bark will remain uncut when the bottom of the tapped surface is reached, *i.e.*, when the tapping of the surface is completed. Each cut connects up with the channel which runs the latex to the spout and into the collecting cup. Both the initial cut and channel are made with a triangular marking knife; there are no knives of this type in the colony, but local firms will be able to supply them within a short time. The vertical channel should not be deep enough to bleed the tree; it must be opened out from time to time as it tends to get filled up. The vertical channel and the cut must be straight and must be made by running the knife along the edge of a wooden lath about ½ inch square placed in contact with the surface of the tree.

To trace the evolution of the tapping systems of the present day—the oldest perhaps was a series of small "V" cuts. These cuts were later made larger and their number reduced. The systems of "V" tapping were eventually evolved (Figs. 1 & 2). The herring-bone (Fig. 4) is a modification of the "V" in which the two arms of the "V" do not meet but alternate with each other. The half-herring-bone (Fig. 3) taps a single quarter of the tree. If another quarter be placed on the opposite side of the tree the system is known as 'opposite quarters' (Fig. 5). These four are the present tapping systems which are principally employed on estates in the East at the present time. The full spiral (Fig 6) and half-spiral are now no longer used. Tapping one-third of the circumference is a comparatively recent system allowing three years renewal, but it has not met with the approval which was anticipated.

In these tapping systems, and more especially in the "V," there has been a tendency to reduce the number of superimposed cuts and to confine the cuts to the bottom portion of the tree. *The greatest yield of rubber is at the bottom of the tree.*

BARK RENEWAL.

The period allowed for bark renewal was placed a few years ago at a minimum of three years; now, perhaps, four years is favoured. A single quarter of the tree tapped every day will allow four years' renewal, if each cut is completed in a year. A "V" or full herring-bone or opposite quarters tapped every other day can likewise be made to allow a renewal of four

years. The distance of the cuts apart comes into effect here. If the cuts are one foot apart, the whole tapping surface is completed in a shorter time than if the cuts are 18 inches apart, at the same rate of removal. One foot and eighteen inches are common distances apart of the cuts in use at present. The latter distance is preferable owing to the longer period allowed for renewal. If twenty cuts are obtained to an inch of bark, eighteen inches of bark will last a year. The present results would indicate that placing cuts at short intervals does not give any greater yield than placing them at one foot or 18 inches apart, while it reduces the period of renewal and increases the cost of tapping. The practice in use on some estates of making the lower cut eighteen inches high and the upper cut one foot high appears to have nothing to recommend it.

With the various systems of tapping in use on the best estates in the East it would appear to be difficult to decide on a suitable system. Some claim the best results from one, some from another system. The results which have recently come to hand from Malaya indicate that the best yields are obtainable by "V"-tapping. The system of tapping young trees on a "basal V," a single "V"-cut at the base of the tree tapped every day, is increasing in favour owing to its high yield and simplicity, and it is adopted by a number of the best estates. When one-half of the circumference of the tree has been tapped by the "basal V," this may be followed by two superimposed "V"-cuts on the other side of the tree, tapped every other day. Mr. E. B. Skinner, who has experimented carefully with this system, is in favour of repeating the "basal V" on the other side of the tree, following this with another single "V" above the first "V," then another single "V" above the second "V" and so on until a six or eight years' renewal of bark is effected on the original "basal V" cut before it is re-tapped. The height of the "basal V" from the ground is 18 inches; with a removal of bark at the rate of 20 cuts per inch, a rate which can and should readily be effected on estates, the surface lasts one year of tapping. The experiments conducted at Kuala Lumpur by the Department of Agriculture of the Federated Malay States indicate too that the "basal V" gives high yields. This system has been recommended to cultivators in this country for opening up young trees. When one "basal V" has been completed it has been recommended that two superimposed "V"-cuts be placed on the other side of the trees and tapped every other day. Alternate day tapping on large area is

recommended in this country in preference to every day tapping in consideration of the present supply of labour. The above system of tapping will give a four years' renewal of bark.

COMMENCEMENT OF TAPPING.

The question arises as to when tapping should be commenced on an estate. It is usually not considered advisable to commence tapping operations until 50 per cent. of the trees have reached a tappable size. When the first trees had been planted in Ceylon it was thought that they would not be able to be tapped until after many years. Opinion has changed much since then and there has been a tendency to reduce the age and size at which tapping is commenced. Twenty inches at 3 ft. from the ground was considered to be the recognised dimension some years ago; later 18 inches was generally favoured, and this is still adopted by many planters, With the "basal V" it is common to open up trees of 18 inches in girth at *18 inches from the ground*, and this dimension has been recommended in this colony. Girth, therefore, rather than age is adopted as the guide to commencement of tapping. Two and a half year old trees have been tapped in the Malay States and have given good yields; but generally trees are not tapped until they are three and a half years old or more.

The influence of an uneven growth in opening up an estate in tapping is sometimes experienced, some of the trees reaching a tappable size long before others. This is in nearly every case traceable to adverse conditions during the period of growth, and in the majority of cases it is due to neglect of weeding or to the planting of inter-crops That the presence of weeds in excess or the presence of another crop materially influences the growth or the tree is no longer a matter for argument.

Passing to the actual process of bleeding the tree, the coolie first collects the scrap which has coagulated in the cuts and on the spout from the previous tapping, he then bleeds the tree and collects the shavings of bark which fall, and so he repeats these operations on another tree. It is customary to commence the flow by adding a few drops of water to each cut by means of the drip from a leaf of the rubber tree; but the addition of water to the cup is now avoided as it renders proper coagulation of the latex difficult to carry out. When the milk is collected the contents of the cup is poured into one pail and the cup is washed, frequently with the aid of a piece of cocoanut husk, in another pail. The former makes first latex rubber after it is strained and the latter what is known as "cup-washings."

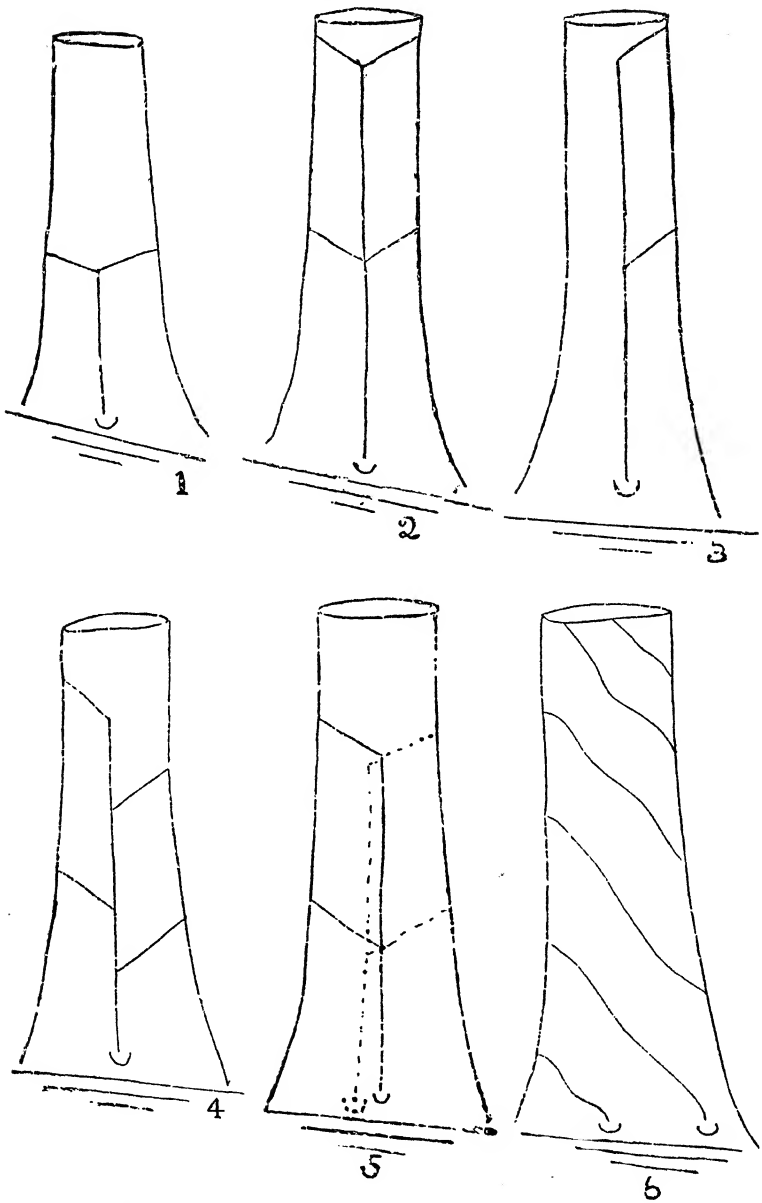
THE TIME TO TAP.

It is almost needless to say that tapping should commence in the early morning, and the earlier the better. Half-past five or six to ten o'clock is the usual tapping time. On rainy mornings tapping is postponed until the afternoon or evening owing to the loss of latex by over-flow from the cuts; the latex instead of running down the channel runs down the side of the tree and cannot be recovered.

With respect to tapping implements, viz., knives, cups, spouts and cup-hangers, the kinds produced and sold on the market are numerous The requirements of a good knife are simplicity and cheapness. It must give a good, clean cut, and must be capable of being easily manipulated and easily sharpened. Various patent knives have been placed on the market, each claiming some special advantage over another; but it is significant that on the immense area of rubber in the Malay States a patent knife is hardly ever seen. The two knives in use are the Gouge and the Farrier knife or its modification, the Jebong. The bent or wry-neck gouge, $\frac{5}{16}$ of an inch wide at the cutting end, is coming into favour in Selangor. It is more easily manipulated than the straight gouge. A consignment of this knife is shortly expected in this colony. The glazed porcelain cups with a flat bottom are strongly recommended in place of cups of glass or tin. Many cup-hangers have been patented, consisting usually of a piece of wire bent in a certain fashion; but these can easily be made from thin galvanised iron wire bent so as to form a loop for the cup and another larger loop to encircle the tree, an additional piece of wire being retained so as to allow for the expansion of the tree in girth. On many estates a stick of wood placed vertically in the ground is used for supporting the cup, the cup being inverted and placed on the top of the stick. Spouts may well be cut out or preferably stamped from thin galvanised iron sheeting. Two and a half inches is sufficient for the length of a spout, and it must be inserted into the tree so that it does not penetrate too deeply or reach the wood of the stem.

This recommendation may finally be included :—*it is advisable to train a force of tappers before bringing any appreciably large area into bearing.* These may best be trained on a few trees which can be retained as a nursery for tappers.

TAPPING METHODS: PARA RUBBER.



1 Basal V. 2 Double V.
3 Half herring-bone. 4 Full herring-bone.
5 Opposite quarters. 6 Spiral.

Insects Injurious to Sugar Cane in British Guiana, and their Natural Enemies.

By G. E. Bodkin, B.A., Dip. Agric (Cantab.), F.Z.S., F.E.S., Government Economic Biologist.

[The following up-to-date list of no less than 32 distinct species of insects injurious to sugar cane in British Guiana has been compiled very largely from records kept in this Laboratory, though a number of observations by Mr. J. J. Quelch, and Mr. H. W. B. Moore must be acknowledged.

LEPIDOPTERA.

(1.) *Castnia licus* Fabr.

Common Name : The giant moth borer.

Natural Enemies :

No known true parasites.

Several species of birds including the Old Witch (*Crotophaga Ani*) and 'Kiskadees' (*Pitangus sulphuratus*) prey on the adult the moth.

(2.) *Diatræa saccharalis* Fabr.
(3.) *Diatræa crinella* Hampson.
(4.) *Diatræa lineolata* Hampson.

Common Name : The small moth borer.

Natural Enemies :

Egg Parasites : *Trichogramma* sp. and an undetermined species of *Telenomus.*

Two undetermined species of Ants destroy both the parasitized and unparasitized egg masses of *Diatræa.*

Parasites on the Larva : Hymenoptera, Braconidae. *Iphiaulax medionus* Cameron : *Iphiaulax* sp : *Cremnops parvifasciatus.* Cam : *Cremnops* sp. Ichneumonidae : *Mesostenoideus* sp. A large species of Chalcidid: *Heptasmicra curvilineata* Cameron, has been bred from Pupa. Diptera : A species of Tachinid (undetermined).

A fungus parasite (*Cordyceps* sp) attacks both larval and Pupal stages.

Predaceous on Larvæ and Pupæ : The larva of an undetermined Elaterid Beetle and the Histerid beetle Lioderma 4 dentatum.

(5.) *Laphygma frugiperda* S & A.

Common Name : The rice caterpillar.

Natural Enemies :

Egg Parasite : *Trichogramma* sp. *Enicospilius guyanensis*, Cameron and an undetermined species of Braconid are parasitic on the larva.

Predaceous on the Larva. The Coccinelid beetle, *Megilla maculata*, de Geer, and the Vespid wasp, *Polybia nigriceps*. Several species of birds and a Toad, *Bufo marinus*, also destroy the larvæ.

(6.) *Remigia repanda.*

Common Name : The grass caterpillar.

Natural Enemies : A Bacterial Disease.

(7.) *Prodenia latifascia* Walk .

(8.) *Lycophota infecta.* Ochs.

(9.) *Monodes agrotina.* Goen.

(10.) *Pamphilla* sp. Hesperidae.

(11.) *Philisora catullus.* Fabr.

From the pupa of (11) an undetermined species of Chalcidid has been bred.

(12.) *Caligo illioneus illioneus.* Cramer.

Natural Enemies :

Egg parasite : an undetermined species of *Telenomus.* A large species of Chalcidid has been bred from the pupa.

COLEOPTERA.

(13.) *Xyleborus* sp,

Common Name : The shot hole borer.

(14.) *Dyscinetus bidentatus.*

Common Name : The small black hardback

(15.) *Cyclocephala signata.*

Common Name : The brown hardback.

(16.) *Phileurus bajulus.*

(17.) *Rhyncophorus palmarum.* Linn.

Common Name : The palm weevil.

(18.) *Metamasius hemipterus.* Linn.

Common Name : 'The Weevil Borer.'

(19.) A small brown species of Chrysomelid Beetle (undetermined.

COCCIDAE.

(20.) *Aspidiotus sacchari.* Ckll.

Common Name : 'The Sugar Cane Aspidiotus.'

Natural Enemies :

An undetermined Chalcidid.

(21.) *Pseudococcus calceolariae.* Mask.

Common Name : 'The Sugar Cane Mealy Bug.'

Natural Enemies :

A fungus, *Aspergillus* sp. Two species of Coccinelids (undetermined) prey on the Mealy Bug. The Coccinelid *Cryptolaemus Montrouzeri* has also been introduced. A number of species of ants foster the Mealy Bug. An undetermined species of lace-wing Fly is also predaceous.

(22.) *Pseudococcus sacchari,* Ckll.

(23.) A species of *Pulvinaria.*

(24.) *Orthezia insignis.* Douglas.

Common Name : 'The Croton Bug.'

(25.) *Pseudococcus citri.* Risso.

HOMOPTERA.

(26.) *Tomaspis pubescens ;*
Common Name : ' Froghopper.'

(27.) *Tomaspis* sp.
Common Name : ' Froghopper.'

(28.) A species of Leaf Hopper (undetermined). The eggs are parasitized by a small Hymenopteron.

NEUROPTERA.

(29.) & (30.) *Termitidae* ; 2 species not yet determined.
Common Name : ' Wood Ants.'

ORTHOPTERA.

(31.) *Locustidae : Conocephaloides maxillosus.* F.

(32.) *Acridiidae. Schistocerca Pallens.* Thunb.

The Coconut and its Troubles.

Cuba is rapidly losing her coconut industry, some localities having already lost about 76 per cent. of their trees from bud-rot. Nearly all countries are greatly troubled by the rat pest. All the Orient is suffering from the red weevil and the black beetle, although in the Philippines there is comparatively very little damage done by either of these two insects. In Malaya, India, and the East Indies, a fungus disease known as the "stem-bleeding fungus" *(Thielaviopsis ethaceticus)* is causing considerable damage but does not appear to be present, thus far in the Philippines.

A root disease, supposed to be caused by a *Botryodiplodia*, affects about one-fifth of the North Travancore district in India, where about 100,000 hectares are in coconuts, and in this area the percentage of attacked palms runs from 5 to 75 per cent. A very serious root disease, as well as "bud-rot," also occurs in Trinidad, British West Indies.

—"Philippine Agricultural Review," February, 1912.

Yields of Varieties of Sugar-Cane: Crops of 1912.

REPORTS, of which 24 were from areas of more than 20 acres each, were received from 26 plantations as to their crops of Bourbon canes during the year 1912. The yields reported varied from .64 ton to 2.04 tons of commercial sugar per acre, the mean return working out at 1.40 ton.

Thirty-one plantations reported their results with D 625, and 29 of these estates recorded the crops of areas of more than 20 acres each of that cane. The extremes of all the returns were .45 ton and 2.40 tons of sugar per acre, the mean being 1.47 ton. On the areas of over 20 acres each the extremes were the same but the mean worked out at 1.50 ton.

Twenty-two plantations reaped D 145 cane, its mean return on all areas planted being 1.43 ton of sugar per acre, whilst the mean return of 16 plantations where areas of more than 20 acres each were reaped was 1.46 ton. On the whole of the trials the extreme yields were .54 and 2.04 tons per acre, whilst on the larger they were .87 and 2.04 tons.

Results were reported by 23 estates on B 208 cane, the extremes being .43 and 2.25 tons of sugar per acre whilst the mean return was 1.36 ton. Sixteen of the plantations reaped areas of more than 20 acres each of this cane, the extreme yields reported by them being .43 and 2.00 tons, whilst the mean yield was 1.29 ton of sugar per acre.

D 109 was reaped on 18 plantations, 14 of which had areas of over 20 acres of it. The maximum of all returns recorded was 1.98 ton of sugar per acre, the minimum return being .49 ton, whilst that of the larger areas was .61 ton. The means were 1.24 and 1.26 ton of sugar per acre respectively.

Six plantations returned B 147 as being under cultivation, five of them having more than 20 acres of it. On all trials the extremes were 1.15 ton and 1.60 ton, whilst on the larger areas they were the same. The mean yields were 1.25 and 1.26 ton of sugar per acre respectively.

The White Transparent cane was cultivated on five plantations, three only reaping areas greater than 20 acres of it. Its extreme yields were .49 and 1.80 ton of sugar per acre, its mean yield on all the plantations being 1.27 ton, whilst on those reaping more than 20 acres of it, it was 1.37 ton.

Returns of the results yielded by B 376 were received from four plantations, on two of which it had been cultivated on arrears of over 20 acres. Its yield varied from 1.20 to 3.33 tons of sugar per acre, being 1.23 and 1.75 ton in the larger trials. The mean yields were 1.88 and 1.50 ton respectively.

D 4397 was reaped on six estates, its yields varying from .66 to 2.00 tons of sugar per acre ; the mean return was 1.26 ton.

Green Transparent was reaped on four plantations, its yields being returned as .89 ton, the minimum, to 2.00 tons, the maximum, the mean working out at 1.54 ton of sugar per acre. On two estates it was cultivated on larger areas the yields being 1.57 and 1.76 ton of sugar per acre with a mean return of 1.64 ton.

Diamond 185 was returned as producing on three estates, from areas over 20 acres each, a mean yield of 1.66 ton of sugar per acre, its lowest and highest yields being 1.25 and 1.99 ton respectively. On another estate on an area of less than 20 acres its yield has 2.06 tons per acre.

The following shows the minimum, maximum and mean yields of certain other varieties :—

		Yields of Tons of Sugar per Acre.		
Canes.	*No. of Trials.*	*Minimum.*	*Maximum.*	*Mean.*
B 1566	2	1.17	1.76	1.47
D 116	2	1.41	1.47	1.44
Sealy	2	1.00	1.87	1.43
D 3956	3	1.25	1.60	1.40
B 109	2	.95	.50	1.22
D 74	2	.65	1.70	1.18

Many varieties, each of which had been reaped on a few acres only, were also reported upon. The yields of the follow-

ing of them were worthy of comparison with their yields in 1911 :—

	Yield of Sugar : Tons per acre.	
Canes.	*1911*	*1912*
B 3412	4.21	2.81
P 6	3.47	1.73
Diamond 382	3.32	1.96
P 2	3.25	1.42
D 130...	2.62	2.02
B 1529	2.20	1.58
D 199...	2.08	1.15
D 419...	2.07	1.50
Diamond 399	1.96	1.49
Diamond 581		2.55
B 1753		2.27

In all forty-seven varieties were reported as under large scale cultivation and trials in 1912.

Last year's data confirmed earlier experience that certain new varieties when cultivated over widely distributed large areas are capable of giving yields considerably in excess of that of the Bourbon.

The areas reported on of each of the principal varieties in 1911 and 1912 were :—

	Acres.	
Variety.	*1911*	*1912*
Bourbon	12,789	8,341
D 625	11,303	16,810
B 208	7,933	8,555
D 145	3,366	4,005
D 109	2,492	3,185
Diamond 185 ...	656	764
B 147	415	344
White Transparent ...	414	183
Green Transparent ...	260	406
B 376	137	17
D 4397	35	57

AREAS OF VARIETIES OF SUGAR-CANE FOR CROPS OF 1913.

Reports have been received from 37 plantations showing that 36 have 25,370 acres occupied by D 625 ; 28 plantations

have 8,241 of B 208; 31 plantations have 5,491 acres of D 145; 22 have 2,755 acres of D 109; 11 have 479 acres of B 147; 8 have 750 acres of Green Transparent; and 5 have 163 acres of White Transparent, whilst on six plantations 1,277 acres are occupied by Diamond 185.

The area occupied by D 625 is 1,701 acres in excess of that under that cane in 1912; an increase of 873 acres is shown by D 145; one of 469 acres by Diamond 185; one of 157 acres by Green Transparent; and one of 207 acres by D 109; whilst the following varieties show decreases in area :—

Variety.	*Decrease.*
B 208	571
B 147	173
White Transparent	40

The following varieties are being cultivated on areas of over 50 acres each :—

Variety.	*No. of Plns.*	*Area : Acres.*
D 4399	5	122
D 115	2	103
D 116	4	103
D 74	2	74
B 376	6	73
D 118	7	58
Diamond 399	3	58

Some seventy other varieties were returned as being under trial cultivation on areas of from one acre to forty-three acres. Very many varieties are under trial in the nurseries of several of the plantations.

48,633 acres are now occupied by canes other than the Bourbon as compared with 46,341 during 1912, the increase being equal in round figures to 5.0 per cent.

The area occupied by the Bourbon cane has been reduced from 22,403 acres in 1912 to 19,250 acres for the crops of 1913. Thus 71.6 per cent. of the land under sugar-cane on sugar estates is cultivated in varieties other than Bourbon.

J. B. HARRISON.

A Leaf Disease of Para Rubber.

By C. K. Bancroft, M.A., F.L.S., Government Botanist.

A FUNGUS which appeared to be a new species was recently recorded as a parasite on the leaves of cultivated *Hevea* on one estate in this colony. The disease was not observed on the older plants in the field but appeared to be confined to the nursery.

Briefly the symptoms of the disease are a spotting of the leaves followed by an increase in the size of the spots with the production of dried areas which eventually fall away from the green parts leaving holes in the leaf surface.

The disease was not particularly abundant. The ease with which the Para rubber plant sheds and renews its leaves renders it less likely to suffer serious damage from a leaf disease than is the case with plants whose leaves are of longer duration. Yet repeated attacks from a leaf fungus must eventually weaken the plant.

PRECAUTIONS AND REMEDIES.

In the case of an outbreak of a leaf disease in a nursery attempts should always be made to prevent its introduction into the planted area. This may be effected by destroying all affected leaves before the plants are put out into the field. Where the Para rubber plants are being planted out as "stumps" the leaf-bearing portion of the plant is necessarily cut away before the "stump" is planted.

A wash which appears to give good result in *Hevea* nurseries is a boiled lime sulphur mixture. It can be prepared as follows:—

Sulphur (sublimed or finely ground), 20lb. or 4lb.; unslaked (quick) lime, 10lb. or 2lb.; water to make 50 gallons or 10 gallons. Heat fully one-third the water. Work the sulphur to a paste with water in another vessel. Add the lime to the heated water, and as it slakes gradually stir in the sulphur paste. Keep stirring and boil until all the sulphur has dissolved and the liquid is reddish-brown; this takes half-an-hour to two hours according to the degree of success in mixing and stirring and the heat of the liquid. Water should be added

during boiling to effect evaporation, and the balance, in whole or in part may be added during this time or all may be added at any time afterwards before use.

Kiln-slaked ordinary lime may be used, but half as much again to twice the quantity, according to quality, is needed. After making, the wash should be strained and the solid matter rejected to avoid unnecessary wear on pump. The presence of sulphur in the remaining solids indicates insufficient boiling.

This mixture would be worthy of trial here as a spray in the event of an outbreak of a leaf disease. In addition to its fungicidal properties it acts also as an insecticide.

The fungus was forwarded to the Director of Royal Botanic Gardens, Kew, where it was identified as a species new to Science and named *Passalora Heveæ*, Massee.

The Alphonse Mango.

The Alphonse (commonly called Apoos) mango is one of the most highly prized fruits of India. It has been called by some the "Prince of Mangoes." Mr. Woodrow in his book on "Gardening in India" mentions that it is universally admitted to be the finest of all varieties of mango. In the *Journal of the Royal Horticultural Society*, page 755, Vol. 26, (1901-02), Maries has made mention of the Alphonse mango and regards it as the most delicious fruit and a general favourite.

Its original home seems to be Goa as the name Apoos (a corruption of the Portuguese name Alphonso) indicates, whence it must have been spread by man.

The Goa Alphonse trees are free growing and of monstrous size, attaining the height of 60 to 80 feet and even more, and bearing profusely sometimes as many as ten thousand fruits, thus proving what a tree can be like, when situated in favourable localities both as regards soil and climate.

—The "Agricultural Journal" of India, April, 1913.

Cacao Experiments, 1912.

By J. B. Harrison, C.M.G., M. A., and S. H. Bayley, Superintendent, Onderneeming School Farm.

DURING the year 1912 the returns of cacao from the manurial experiment fields at Onderneeming School Farm were as follows :—

YIELDS OF WET CACAO OR "PULP" PER ACRE.

Plots.		Lbs. per Acre. *Yields.*	*Probable error excess or deficit.*
Nos. 1, 4, 7, 11, & 16	No Manure ...	1,140	29
Nos. 3, 8 & 13	Heavily mulched ...	1,371	45
Nos. 12 & 18	Sulphate of ammonia only ...	1,005	55
Nos. 6 & 14	Superphosphate of lime and sulphate of potash ...	1,446	73
Nos. 5, 10 & 15	Superphosphate of lime and sulphate of ammonia ...	1,310	85
No. 9	Sulphate of potash and sulphate of ammonia ...	1,200	146
Nos. 2 & 17	Superphosphate of lime, sulphate of potash and sulphate of ammonia	1,383	91

These returns are equivalent, on the assumption that the "pulp" yields 36.6% of its weight of cured cacao, to the following :—

Plots.	Lbs. Per Acre. *Yields.*	*Probable error excess or deficit.*
Nos. 1, 4, 7, 11 and 16	410	11
Nos. 3, 8 and 13	494	16
Nos. 12 and 18	361	20
Nos. 6 and 14	520	27
Nos. 5, 10 and 15	479	31
No. 9	432	53
Nos. 2 and 17	506	33

During the year the mean yields on the mulched plots were somewhat in excess of those receiving superphosphate of lime and sulphate of potash only. The manuring with superph sphate of lime and sulphate of ammonia, with sulphate of potash and sulphate of ammonia, and with superphosphate of lime, sulphate of potash and sulphate of ammonia produced but little increase which under the conditions of the trials could be safely ascribed to the manurings, whilst the application of the purely nitrogenous manure—sulphate of ammonia—although adding to the apparent vigour of the trees resulted in yields lower than the mean yields of the unmanured plots.

During the four years—1909 to 1912—the total crops of wet cacao were as follows :—

Plots.		Lbs. Per Acre. *Yields.*	*Probable error excess or deficit.*
Nos. 1, 4, 7, 11, & 17	No Manure ...	4,762	155
Nos. 3, 8 & 13	Heavily mulched ...	6,192	199
Nos. 12 and 18	Sulphate of ammonia only ...	4,475	349
Nos. 6 & 14	Superphosphate of lime and sulphate of potash ...	5,974	285
Nos. 5, 10 & 15	Superphosphate of lime and sulphate of ammonia ...	5,472	357
No. 9	Sulphate of potash and sulphate of ammonia ...	5,027	468
Nos. 2 and 17	Superphosphate of lime, sulphate of potash and sulphate of ammonia	5,542	176

These correspond to the following :—

Plots.	Lbs. Per Acre. *Yields.*	*Probable error excess or deficit.*
Nos. 1, 4, 7, 11 and 16	1,714	56
Nos. 3, 8 and 13	2,227	71
Nos. 12 and 18	1,610	127
Nos. 6 and 14	2,150	90
Nos. 5, 10 and 15	1,977	165
No. 9	1,810	170
Nos. 2 and 17	2,005	64

These results show that the highest yield of cacao during the four years has been on the heavily mulched plots on which there has been a minimum increase of about 385 lbs. of cured cacao or about 97 lbs. per acre per crop over the mean yield of the five non-manured plots. But the cost of the mulching to produce 385 lbs. of cacao, worth say $46 has been at least $66.

On the other hand the application of sulphate of potash and superphosphate of lime, costing approximately $14 during the four years, has given a minimum increase of 290 lbs. of cacao, worth, say $35.

The quick-acting nitrogenous manure—sulphate of ammonia—has lessened the yields both when applied to otherwise unmanured land, or when added to manurings of superphosphate of lime and sulphate of potash.

The application of lime to the land has not had any effect, the weight of wet cacao produced on the 18 plots of limed land during the four years, having been 5,367 lbs. per acre as compared with 5,356 lbs. per acre yielded by the 18 plots of not limed land.

The experiments have indicated that under conditions similar to those existent at Onderneeming farm the methods of cultivation precedent to the successful growth of cacao are :—

1. The reduction of "shade" to the lowest amount compatible with due protection from wind.

2. Deep and efficient drainage, certainly not less than from 3 to 4 feet.

3. Annually forking the land between the trees in such a manner as not to injure their roots more than is absolutely unavoidable, whilst effectually turning up the soil for aeration and drainage and thus constantly adding to the depth of tilled surface soil and the feeding area available for the roots of the trees. To do this requires the services of skilled forkers working under strict supervision.

4. Mulching the soil but only so far as can be done at a low cost per acre; such cost not exceeding, say, $6.

5. Manuring the trees with a mixture of superphosphate of lime and sulphate of potash. The cost of such application should not exceed $4 per acre.

Experiments with Varieties of Rice at the Botanic Gardens, 1912.

EXPERIMENTS with local and imported kinds of rice were continued during 1912 at the experimental fields, Botanic Gardens, with the following results :—

Selected Varieties.	*Bags (120lbs.) of Padi per acre.*
Creole	44.5
No. 6	44.1
No. 75	42.7
Variants	
No. 75 Var. 6	42.7
No. 75 Var. 7	40.0
No. 6 Var. 1	40.9
Creole Var. 1	34.0

Taking the series of eight years (1905-1912 inclusive) during which these trials with the selected varieties have lasted the results work out as follows :—

Kinds of Rice.	*Bags (120lbs.) of padi per acre.*	*Creole taken as 100.*
No. 6	38.0	107.5
No. 75	36.7	103.7
Creole	35.4	100.0

The large scale trials—on ½ acre plots—of the variants did not result in the relatively high yields obtained from them on smaller plots during the preceding year.

In duplicate and triplicate comparative trials on smaller areas 1-16th acre plots—the following results were obtained.

Variants.	*Bags (120lbs.) of padi per acre.*
Demerara Creole	37.9
Berbice Creole	14.9
Surinam Creole	26.0
Surinam Creole Var. No. 2 ...	18.7
No. 3 (type)	39.2
No. 3 (variant) 1	37.2
No. 6 (type)	39.0

(C't'd.) *Variants*	*Bags (120lbs.) of padi per acre.*
No. 7 (type)	33.7
No. 75 Var. No. 1	42.7
No. 75 Var. No. 8	40.1
No. 75 Var. No. 5	38.6
No. 75 Var. No. 2	35.7
No. 75 Var. No. 4	27.8

Twenty-six $\frac{1}{8}$th acre plots were cross-dressed with sulphate of ammonia whilst 26 plots (their duplicates) did not receive any nitrogenous manurings. The returns on 22 of the plots not receiving nitrogenous manure were higher, and generally decidedly higher, than were those from the corresponding cross-dressed plots: on 3 plots the returns from the cross-dressed plots were higher than those from the non-manured whilst on one the returns were the same on both cross-dressed and not cross-dressed plots.

THE EFFECTS OF SULPHATE OF AMMONIA.

The mean results of the twenty-two duplicate plots on which the higher yields were obtained show that 40.8 bags were obtained where sulphate of ammonia was used as compared with 43.7 bags where it was not applied. The rice manured with sulphate of ammonia was in every case badly laid. The prolonged drought of 1911-1912 during which the rice-field was in fallow resulted in an accumulation of available nitrogen in the soil sufficient, and (from the appearance of the field) more than sufficient, for the needs of the rice-fields. The nitrogen added merely increased the luxuriance of growth of the stems of the plants with the sacrifice of some of their rigidity thus causing the rice to be early laid and thus preventing the proper maturation of the grains. That this was due solely to the excess of nitrogen and not to a deficiency in the soil of available phosphates and potash was shown by comparative trials where the soil was manured with sulphate of potash and superphosphate of lime at the rates respectively of 1 and 4 cwt. per acre. In these trials the results were invariably higher on the plots not cross-dressed with sulphate of ammonia.

J. B. H.

Areas under Cultivation.

THE returns from the Commissaries gave the following figures for the areas under cultivation in the colony during 1912.

		1911–12.	*1912–13.*
Canes	...	68,744	67,883
Rice...	...	36,025	41,924
Coconuts	...	12,236	13,698
Cacao	...	2,127	1,983
Coffee	...	2,836	2,896
Rubber	...	2,239	3,139
Limes	...	658	739
Provisions	...	18,441	18,623

STOCK.

The following figures are given for stock in the colony :—

Donkeys	...	5,370	5,780
Cattle	...	81,500	72,000
Goats	...	11,170	11,800
Sheep	...	19,150	16,500
Swine	...	17,000	14,000

Linseed Cake as a Cattle-food.

For the past ten yeasr an important series of sheep and cattle feeding experiments has been carried out by Mr. Bruce, and the results were very ably summarised by Mr. Watson. A remarkable feature was the pre-eminent position of Linseed cake as a food, animals fed on this always making greater progress than those on other substances. Better results were also obtained with Bombay cotton cake than with Egyptian cotton cake, in spite of their apparent identity on chemical analysis. A mixture of wheat, cotton-seed and cotton cake made up to give the same analysis as linseed cake proved economically a failure. The conclusion is drawn that our present methods of valuing feeding stuffs do not afford particularly useful information.

—The "Agricultural Journal" of India, April, 1913.

Areas and Yields of Rice: Crops of 1912.

THE returns received from the District Commissaries show that during the year 1912, 41,924 acres were cultivated in rice, the total yield being 827,000 bags of paddy or at the rate of 19.7 bags per acre. In 1911 36,000 acres yielded 748,400 bags or 20.8 bags per acre. There was therefore in 1912 an increase of 5,924 acres and of only 78,600 bags of paddy as compared with the returns of the previous year.

Owing to the persistent drought the spring crop of rice for 1912 was either not planted or as usual was more or less a failure. In North Essequibo, however, 200 acres were reaped and gave a return of 3,800 bags of paddy or at the rate of 19 bags per acre.

J. B. H.

Why the German Farmer has Succeeded.

The ultimate reasons why the German farmer should have made such notable advances in intensive farming would probably have to be sought in a comparative study of national temperament and of economics; but the more immediate and practical reason is a matter of the amount of capital and labour and thought expended upon each acre of land. The German farmer prepares his fields so that they look like a garden, and he sees that his soil is in fine condition before he plants his crop. He exercises great care in the selection of his seed, and aims at as perfect a stand as possible. He has learned how to fertilize his crops and for this purpose he saves every bit of waste on his farm and returns it to the land. He carefully preserves his stable manures and then generously supplements them with commercial fertilizers. He knows, moreover, how to use commercial fertilizers, and one great lesson he has learned, a lesson that every good farmer learns, is that they are not to be used to replace stable manure, but to supplement it. He knows the value of humus, and his land is easy to cultivate and will hold rain water that falls on it; it is neither too sandy on the one hand, nor too clayey on the other. To add humus to his soil, he grows leguminous crops and ploughs them under, and he applies stable manure also.

—"The Agricultural Journal of the Union of South Africa," April, 1913.

Poultry Keeping for Profit in British Guiana.

By S. H. Bayley, Superintendent, Onderneeming School Farm.

In the February number of the "Journal of the Board of Agriculture" (England) an interesting article on "Experimental work in Artificial Incubation" is contributed by W. Brown. Although comparatively few people in this Colony use incubators, the subject is of interest and it might be possible to obtain the experiences of those readers of "The Journal" who have tried incubators as a means of hatching chickens, in order to find out what degrees of success have been obtained, and whether in the opinion of any the results have been really satisfactory. It is with this object that I venture to state our experiences at the Onderneeming farm during the past eight years, and the Editor of this Journal informs me that he will be glad to have the views of any readers who may be inclined to contribute them either in the form of an article or as a letter.

In the article quoted above Mr. Brown says: "All practical poultry keepers will probably agree that the results obtained by artificial incubation are not equal to those obtained by natural means. This fact is demonstrated in two ways, namely, by the lower hatching percentage with incubators and the higher vitality of the chickens hatched under a hen."

This has certainly been our experience, and both as a result of the low vitality of the chickens, and on account of the absence of a natural mother, the mortality among incubated chickens raised in a brooder has proved very much higher than among those raised by natural process.

TWO QUESTIONS.

Then the questions arise, are incubators a necessity in this colony; and is it cheaper to artificially incubate or to hatch by natural process?

In England, America, and similar countries where poultry farming is prosecuted on a very large scale, I assume that it would be impossible to accommodate the requisite number of sitting hens necessary to carry all the eggs to be set, even if such hens were easily obtainable. Our experience at Onder-

neeming with imported poulty has been that while our hens lay large quantities of eggs they do not often indulge in "a sitting mood." As an example of this I may mention that seven Plymouth Rock hens imported in October last laid 308 eggs in four months, during which time only one 'came on the cluck.' If these hens behave in a similar manner in their own country it is easily conceivable that incubators are very necessary. In this colony, however, conditions are different; the common creole hen having laid an average of eight or ten eggs is persistent in her demands to be allowed to sit, so that even if poultry-farming were prosecuted on a very much larger scale than has (so far as I am aware) ever been attempted in the colony, no great difficulty would be experienced in providing the natural hatching process.

RESULTS FROM INCUBATORS.

The Onderneeming farm possesses four incubators (three Cypher's and one Cornell's—all made for 100 eggs) and three or four years ago they were much used, while recently hens only have been employed for incubating purposes. Let us compare the results of the two methods. The best hatch ever obtained was from the Cornell incubator and gave 61 chickens out of 97 eggs; the average hatch, however, proved to be 29% only. These incubators, which are ten to twelve years old, while not possessing all the most recent and up-to-date improvements, are fitted with thermostats (which acted with great regularity) and were tended by responsible officers of the farm. The chickens when one day old were moved from the incubators into brooders or "foster-mothers" which were artificially heated at night for the first month. For supplying heat to the incubators one bottle of kerosene oil per day was necessary and for the brooders half a bottle. One bottle costs about 7 cents. I have not got any reliable figures of the number of chickens which died during the first month in the brooders, as compared with those under hens, so we will assume that all survived, in which case we find that 100 eggs produced 29 chickens one month old costing $2.52 or nearly 8⅔ cts. each. (Oil for incubator lamps 21 days @ 7 cts. and for brooder lamp 30 days @ 3½ cts.)

RESULTS UNDER HENS.

The results obtained from incubating by natural process have proved more satisfactory. The average hatch from a sitting of 10 eggs has given 8 chickens or 80 %. The cost of

feeding 10 hens (to cover 100 eggs) for 51 days @ ¾ cts. per hen per diem equals $3.82; thus we have 80 chickens one month old costing $3.82 or 4⅘ cts. each as compared with 8⅔ cts. the cost of an artificial incubator chick of the same age. It will be observed that no account has been taken of the initial cost either of the incubator, (about $35) or of the sitting hens (about $3.60), nor has the loss of 71 eggs in the incubator against 20 under hens been reckoned. These figures are all in favour of the hen.

THE HEN WINS IN BRITISH GUIANA

From the above it will be seen that hens have proved far more economical than artificial incubators, nor have we had the slightest difficulty in procuring sitting hens when required, at an average cost of 1/6 each. These hens after hatching carry their chickens for 6 to 7 weeks, then lay, and are ready to sit again in about 15 days.

I have often heard it stated that poultry-farming or "keeping fowls" (the local expression) does not really pay, but I think that if the methods employed were a little less haphazard, the house-wife—particular in country districts—would find it remunerative. To the numerous colonists who at present keep three or four dozen fowls, I would suggest trying to breed a better class of bird. This should be easy of accomplishment working somewhat on the following lines:—Weed out every common cock or cockerel and procure and keep only first-class male birds—one to every 10 or 12 hens and pullets. Where means permit, it would be wise to use only pure-bred birds and in this connection it might be mentioned that experiments at Onderneeming with different breeds of both English and American poultry including Langshans, Black Minorcas, White Minorcas, Light Brahmas, White Game, White Leghorns and Plymouth Rocks have proved that no strain is better suited to this climate than the Plymouth Rock which also has the advantage of being a first-class "general purpose" bird. It is possible to import these birds at a landed cost of about $8 each for cockerels 7 to 8 months old, and $5 each for pullets of the same age, while the Onderneeming Farm charges for locally born pure Plymouth Rocks 7 months old $3.50 for a single cokerel, and $8.50 for a trio (one cockerel and two pullets). If the possessor of a run with say 40 creole hens and pullets procured 2 trios and two single cockerels of pure-bred Plymouth Rocks (costing £5 *i.e.* 2 trios @ $8.50=$17.

and 2 cockerels @ $3.50 = $7) he would be able to breed both a large number of half-bred and a small number of pure-bred fowls. All his half-bred cockerels would be disposed of at 5 or 6 months old, while he would gradually replace his common hens with the best of his young half breeds. Aided by judicious selection he should in this way be able to considerably increase the size and quality of his birds. His pure-bred pullets would supply new cockerels from time to time for his own use while he would find a ready market for any trios that he cared to dispose of. I have repeatedly seen young Plymouth Rocks of only fair size and not particularly well barred, fetch $10 a trio at auction sales in Georgetown. It would, of course, be advisable after the first year to periodically introduce new blood, and this might be done either by exchanging cockerels with other breeders, or by investing some of the proceeds of sales in importing birds.

The Sanitary Tropical House.

The sanitary houses were models constructed by the division of sanitary engineering and demonstrated the unit idea to be followed in tenement-house construction, each house being separated from the adjoining one by a party wall and having its own kitchen, water-supply, water-closet, and drainage, with galvanized-iron roofs and gutters, and free through ventilation from front to back of house; this was secured by large double opposing windows in front and back walls, as well as large openings in all cross-sections of rooms to facilitate the free passage of air through all parts of the house. Each unit has its own back yard entirely fenced in by a closed type of fence, while the part devoted to the kitchen, etc., is separate from the house and connected with it by a short covered or uncovered passageway. Where upper and lower floors are occupied by separate families, each floor is a complete unit, the upper one having its own stairway leading to the street; the lower floor, excepting the passageway, is raised about 1 meter from the street level, the most striking feature being the unusually large window and door openings in both the front and back of the house. The model of the nipa house constructed especially for tuberculous persons gives a much larger comparative area of window space than is customary, and the front and back of the house are provided with large covered porches connected with the house by doors and intended for use as sleeping quarters, they being located on opposite sides and near the corners of the house to afford shelter in inclement weather.

—"Philippine Agricultural Review," April, 1912.

Entomological Notes.

Another predaceous enemy of Diatraea.

THE Hesterid Beetle *Lioderma 4. dentatum* has shown that it is a true predaceous enemy of the moth-borer. It is a small shining black beetle with the typical appearance of the insects belonging to this family. We have to thank Mr. J. Dodds, of Anna Regina, for the observation.

Parasite of *Brassolis sophorae*.

A LARGE Chalcidid, *Chalcis annulata* F. has been recently obtained from the pupa of this well-known Coconut palm pest. It is of interest as it is the first authentic parasite that has up to the present been secured from *Brassolis* in British Guiana. *C. annulata* is parasitic however on a number of other Lepidopterous insects.

Determination of the Cocinellid enemy of the *Laphygma frugiperda* S, and A.

IN the last issue of the journal (Vol. VI. No. IV., pp. 181.) a Cocinellid Beetle was recorded as preying on the larva of this pest. We have now received the determination of this insect from the Director of the Imperial Bureau of Entomology, and it proves to be *Megilla Maculata*, de Geer. It has been observed again this year to perform excellent work in the reduction of *Laphygma*.

Two Species of Orthoptera injurious to Sugar-Cane.

(Locustidæ :) *Conocephaloides maxillosus.* F. ; (Acridiidæ). *Schistocerca pallens.* Thunb. Both do considerable damage by feeding on and often destroying the growing shoots of the cane. Another form of damage is to bite out, from the under side, a portion of the midrib of fully developed leaves, thus causing the entire destruction of the leaf. The Locustid is often to be found during the heat of the day hiding in the axils of the leaves ; the Acridiid is altogether a bolder insect.

Coccids on Cane.

WE are indebted to Mr. J. Dodds, of Anna Regina, for originally observing a severe attack of the well-known Coccid *Orthezia insignis*, Douglas, on sugar-cane.

Another Coccid or Scale Insect has recently been observed to occur occasionally in small numbers on tops used for replanting. This is *Pseudococcus citri*, Risso, the well known pest of Citrus plants, Cacao, Crotons, and some species of ferns in British Guiana. It has never been previously reported on sugar cane.

Parasites of *Diatraea striatalis* in Java.

THE following insects have been recorded by Mr. P. van der Goot, Entomologist to the Experiment Station for the Java Sugar Cane Industry, as being parasitic on *D. striatalis* which he regards as being practically identical with *D. saccharalis* :— Egg Parasites ; *Phanurus beneficiens* Zehnt. (= *Ceraphon beneficiens*. Zehnt) ; *Trichograma minutus* Riley (= *Chactosicha nana* Zehnt.) Parasites on the larva :— A small undetermined species of Braconid and a species of Tachinid fly.

A New Parasite of *Diatraea saccharalis* L.

FROM a large consignment of Diatræa pupae recently received there emerged several large yellow Chalcidids. There appearance is quite characteristic, being just under a centimeter in length, and with the abdomen tapering gradually to a sharp point. Examination showed them to be identical with *Heptasmicra curvilineata*, Cameron. The insect has on several occasions previously been observed in the cane-fields, and although its relationship to Diatræa was suspected the proof has only now been obtained.

The Stable Fly (*Stomoxyx calcitrans*) and Rice Straw.

F. C. BISHOPP, in the Journal of Economic Entomology, VI., No. 1., Feb., 1913, pp. 112–120, draws attention to the danger of allowing stacks of straw to rot and thus provide a very excellent breeding place for *Stomoxys*. In this connection it may well be pointed out that the local practice of allowing rice straw to lie and rot in large heaps for long periods of time is an objectionable one. The Stable Fly is already abundant, too much so in fact, and in considering the supposed transmission of certain recent veterinary diseases by this insect, every effort should be made towards its suppression.

New Cane Pests.

THE following species of insects observed to be injurious to sugar cane in British Guiana are recorded here for the first time :—(*a*) *Prodenia latifasciata*, Walker. The larva of this Noctuid moth conceals itself during the day in the axils of the cane blades, coming out only at night to feed. They have been recently observed to be present in small numbers on some plantations, but probably occur more generally. The larva is either dark green or brown in colour, and stout in shape. Pupation takes place in an earthen cell beneath the surface af the ground.

(*b*) A species of Chrysomelid Beetle about 5 millimeters in length, dark brown in colour, and rounded in shape is responsible for the row of circular holes often seen in several places across the same cane blade. This is caused by the beetle chewing out portions of the young green central shoot before it has opened and is tightly rolled up, disfigurement and weakening of the leaf as previously described being the result. Specimens of the beetle have been forwarded to the Director of the Imperial Bureau of Entomology for identification purposes.

—G. E. B.

The Spread of Coffee Leaf Disease.

The French Government has recently passed a law to prevent the spread of the coffee blight in the coffee-growing colonies of that country. Though it is not definitely known how this blight entered the Philippines, it is probable that it came in by way of the southern islands from Java or Singapore in the early eighties. This blight by 1885 or 1886 had spread throughout the great coffee-growing centres of Batangas and Laguna, and by 1890 the industry was practically destroyed.

If this terrible disease, which is known to science as *Hemileia vastatrix*, should gain entrance into Brazil, the price of coffee would probably be trebled within five years.

Had there been adequate measures and regulations, regarding the importation of plant material into the Philippines, in operation at the time of the entrance of this fungus, it is believed many millions of pesos would have been saved to the coffee planters of Luzon.

—"Agricultural Review," Philippine, June, 1912.

Control of the "Rice Worm."

By G. E. Bodkin, B.A., Government Economic Biologist.

THE attention of all rice cultivators is drawn to the following methods for stopping the attacks of caterpillars on young rice, which will prove sufficiently effective if carefully and conscientiously carried out.

It is most important that as soon as the green shoots of the young rice make their appearance a careful watch should be kept for the appearance of the caterpillars. As soon as they are seen steps should be taken for their destruction. If allowed to grow they will quickly destroy all the plants.

For those who are in a position to use poisonous insecticides the following method may be employed. Specially prepared powdered arsenate of lead should be dusted lightly over the plants, which will quickly poison the caterpillars. The application can be made by beating the powder through light cloth sacks or by means of a dusting machine. This powdered lead arsenate and the dusting machines may be obtained from a number of reliable firms, concerning which particulars may be had on application at this office. It should be remembered that arsenate of lead is very poisonous and requires handling with care.

As the caterpillars do most damage when the rice plants are only a few weeks old destroying them by means of flooding is another very effective method and should be carried out as follows wherever possible. In preparing nursery beds for young rice the dams should be made sufficiently high so that the nursery can be flooded and the plants completely covered with water. By this means the caterpillars are floated off the plants on to the surface of the water and may be there easily collected and destroyed.

When flooding the beds is not possible (which seldom occurs) the caterpillars should be picked off the plants by hand and dropped into a tin containing water and a little kerosine. This is not a difficult task as the majority of the nursery beds are small and the work is easily performed by children. For this purpose dams should be made in the nursery beds when first constructed so that any part of the rice is easy to get at. Small

perches for birds that eat the caterpillars should be placed in the nursery beds, actual cases have been observed where these have proved exceedingly useful.

Where a large number of nursery beds occur together the growers should co-operate in the destruction of the caterpillars. It is useless for a small number of the growers to destroy the caterpillars if the others allow them to go unchecked on their plots. For under these conditions the caterpillars will quickly spread from one nursery to another.

Finally the ground about the rice cultivation should be kept as free from grass and weeds as possible. It will be found that this is a very great help in keeping the caterpillars away from the rice.

Other cases of insect attack should at once be reported at this office, when advice as to methods of control will be readily given.

The Principles of Humane Slaughtering.

All animals, without exception, must be stunned, or otherwise rendered unconscious, before blood is drawn.

Animals awaiting slaughter must be so placed that they cannot see into the slaughter-house, and the doors of the latter must be kept closed whilst slaughtering is going on.

The drainage of the slaughter-house must be so arranged that no blood or other refuse can flow out within sight or smell of animals awaiting slaughter, and no such refuse shall be deposited in proximity to the waiting pens.

If more animals than one are being slaughtered in one slaughter-house at the same time they must not be within view of each other.

None but licensed men shall be employed in or about slaughter-houses.

—"The Agricultural Journal of the Union of South Africa," April, 1913.

Hints, Scientific and Practical.

Respiration and Assimilation in Plants.

ANOTHER experiment may be carried out to illustrate further the processes of respiration and assimilation. About a hundred barley grains are soaked and placed with a little water in a stoppered bottle holding about a pint, the stopper is left out and the bottle exposed to the light until the barley has shot and made a fair amount of leaf. The stopper is then inserted, and the bottle is put away in a dark cupboard or drawer for two days; on taking it out and testing the air in the bottle by means of a lighted taper, the taper will be extinguished. In the dark only respiration has been going on, and so much carbon dioxide has been produced and so much oxygen used up that the air in the bottle is no longer capable of supporting combustion. Now stopper up the bottle again and stand it in the light for two days; again test the air it contains with a taper, and it will be found to support combustion. In the light the green leaves of the barley have split up the carbon dioxide and replaced it by oxygen, until the air will once more support combustion. The bottle may be replaced in the dark until respiration has again loaded the air with carbon dioxide, whereupon it may again be brought into the the light and the air reoxygenated by the assimilation carried out by the green leaves; these alterations may be repeated several times, until at last the barley begins to die for lack of food. Under slightly more natural conditions, however, such a cycle of respiration and assimilation can be continued for very long periods.

—A. D. Hall, M.A., F.R.S., in "The Feeding of Crops and Stock."

The Circulation of Nitrogen.

THE circulatory process through which combined nitrogen passes is very plain. Animals only use the highly organised compounds like the proteins; these they break down during their vital process to simpler compounds like urea and amides, which in turn are taken by plants and built up once more into the protein complexes. The nitrogen, however, only circulates from one form of combination to another with occasional losses

when the compound is broken down as far as elementary nitrogen; there is never any bringing of fresh elementary nitrogen into the account. The stocks of combined nitrogen that have been handed down from past ages all speak of the same organic circulation, never of fixation.

Coal is but the débris of an extinct vegetation; nitrate of soda represents the glorified result of the same decay processes which give rise to nitrate of potash in India and nitrate of lime in the old nitre beds. Virgin soils with their vast stores of nitrogenous humus are often looked upon as having gained nitrogen by the accumulation of long epochs of vegetable growth; but if plants cannot fix nitrogen there can have been no gain, however long the growth, but only a circulation of the pre-existing combined stock. At first sight there seem to exist no processes which can either bring about the original combination or renew the stock from time to time. Inorganic agencies are certainly trifling, because nitrogen is a difficult element to bring into combination, so great an initial expenditure of energy is required to separate the atoms in the gaseous molecule. Electric sparks will effect a combination of nitrogen and oxygen, and lightning flashes through the air have been invoked to account for the trace of nitric acid to be found in the atmosphere and in rain water. Again it has been supposed that during the evaporation of water there is always a slight combination of nitrogen with the elements of water to form ammonium nitrate, but more recent and refined experiments are against the existence of any such reaction.

—A. D. Hall, M.A., F.R.S. in "Fertilizers and Manures."

The Localised Nature of Soil Reaction.

In one essential respect the conditions prevailing in the soil are very different from those of the laboratory. In the soil all reactions are extremely localised, since they take place in the thin film of water normally surrounding the soil particles, in which movement of the dissolved matter takes place very slowly, mainly by diffusion. Of the extreme slowness of the diffusion of soluble salts in the soil the Rothamsted experiments afford some good examples. For instance, on the grass plots only an imaginary line divides the plots receiving different fertilizers; the manure is sown right up to the edge of the plot, a screen being placed along the edge to prevent any being thrown across the boundary, then

immediately on the other sides of the boundary the different treatment begins. In two cases plots receiving very large amounts of soluble fertiliser, *e.g.*, 550 lb. per acre of nitrate of soda, or 600 lb. per. acre of ammonium salts march with plots receiving either no fertiliser or a characteristically different one, yet in neither case is there any sign in the herbage that the soluble fertiliser has diffused over the boundary. Although the treatment has been repeated now for fifty-two years, the dividing line between the two plots remains perfectly sharp, and the rank herbage produced by the excess of nitrogenous fertilser on one side does not stray 6 inches over the boundary. Again on the Rothamsted wheat-field the plots were 24.7 feet in breath, and were separated by unfertilised strips only about a foot in breadth ; in 1893, each plot was sampled down to a depth of 7.5 feet, and the amount of nitrates was determined in each successive sample of 9 inhces in depth. The amount of nitrates found was in each case characteristic of the supply of nitrogen to the surface of the plot, and right down to the lowest depth there were no signs of the proportions approximating to a common level, as they would have done had any considerable amount of lateral diffusion been taking place. Considering that the plots are only separated by a foot or so of soil, and each had been receiving its particular amount of nitrogen for forty and in some cases fifty years, the sharp differentiation of plot from plot in the amount of nitrates at the depth of 7 feet is sufficiently remarkable, and is evidence that the movements of the soluble salts in the soil are almost wholly confined to up and down motions due to percolation and capillary uplift, lateral diffusion taking place only to an insignificant extent.

—A.D. Hall, M.A., F.R.S., in " Fertilizers and Manures."

The Effect of Grass on Fruit Trees.

Conspicuous among the results obtained at the Woburn Experimental Fruit Farm are those relating to the effects produced by growing grass above the roots of fruit trees. From the economic point of view the question is naturally one of the considerable importance to the fruit grower but it presents a still more important aspect in its bearing on the fundamental problems of soil-fertility and the effect which one crop has on another. The mere fact that if grass be grown above the roots of fruit trees it has a deleterious effect seems to have been acknowledged previously by some growers,

though it was denied, indeed is still denied, by others. The chief reason for this divergence of opinion lies, no doubt, in the fact that the effect produces by grass varies greatly according to the nature of the soil and, in some few cases, may even be negligible: in practice also the grassing of land under fruit is generally carried out gradually, a form of treatment which materially reduces the evil effects; moreover, grassing is hardly even practised in such a way that the grower has an opportunity of estimating by comparative trials what the effect has really been.

In the case of many soils, when the grassing is done so as to secure the maximum effect—for instance, when young trees are planted either in land already grassed or in land which is laid down to grass at once after the planting—the effect is practically always a fatal one.

Unless the grass be allowed to act during so long a period that tree becomes permanently stunted, the tree will recover its vigour as soon as the ground is cleaned, in the same way, a limited recovery begins at once when any of the roots pass outside the grassed area. On the other hand, the grass-effect is noticeable when even a very small proportion of the roots are in grassed ground; for instance when only three or four ounces of the roots of trees weighing 2 cwt. are under the grass.

It cannot be stated with certainty how far it is necessary to clear the grass away from around the roots of trees so that these may not be affected; indeed, this must evidently depend on the size and nature of the trees. In the case of freshly planted young trees, a clear space three or four feet in diameter may be advocated, though some benefit has been noticed when the clear circle has been enlarged to six feet in diameter; on the other hand, benefit has been noticed even when the grass was cleared away over a space extending only six inches away from the stems.

—Spencer Pickering, F.R.S., in "Science Progress," April 1913.

What Plants are made of.

Among the more important of these universal constituents of plants we may place first of all the carbohydrates, a great group of substances so called because in them the elements, carbon,

hydrogen, and oxygen are combined together in the proportions that suggest a combination of carbon with water. The carbohydrate group includes the sugars, so easily recognisable in the sugar-cane and the beet-root, but also detectable in fruits (a raisin is most easily tested), and by special tests in the leaves and other parts of the living plant. Then come the starches, which are readily washed out of flour, potatoes, and many other storage organs of plants; also certain gums and mucilages, which are closely related to the starches. Finally, we can include the celluloses and fibres, which we obtain in a very pure state in the simple vegetable cells constituting cotton and linen, and less pure in other fibres such as hemp and jute, and in wood itself.

Rather more concentrated than the carbohydrates, *i.e.*, containing still only carbon, hydrogen, and oxygen, but with a higher proportion of cabon, are the fats, oils, and waxes which are present in many vegetable tissues; but only in the seeds, nuts, and fruits of certain plants is there enough to be squeezed out for commercial purposes. The seed is always a very concentrated storehouse of food for the future plant, and it is in the seed that such concentrated materials as oils and fats are mainly found.

So far the compounds have only contained carbon, hydrogen, and oxygen, but in all plants there is another group of compounds built up as before with carbon as the centre, but with nitrogen also as part of the fabric. Of these compounds containing nitrogen the most important are the proteins (in older phraseology proteids or albuminoids), complete bodies containing carbon, nitrogen, hydrogen, oxygen, and smaller proportions of sulphur and phosphorus. Perhaps the easiest of these bodies to separate is gluten from wheat flour, but by suitable tests they may be recognised in all plants and in all parts of the tissues. The proteins are very elaborately constructed bodies, and are either insoluble or not properly soluble in water; but as a sort of intermediate stage in their building up or breaking down, come certain simpler soluble compounds of carbon, hydrogen, oxygen and nitrogen, often called amides, though the name is not very correct, and it will be simpler to call them *a*-proteins.

Of course the carbohydrates, the fats, the proteins are not the only groups of compounds occurring in plant materials: there are also bodies like the essential oils, which give scent to

to plants, the resins, the vegetable acids, the bitter and poisonous principles, etc., etc.; but the three groups enumerated constitute by far the greater part of every plant, and on them only depends, at least, in its broad outlines, the life of the plant and in its turn of the animal.

—A. D. Hall, M.A., F.R.S., in "The Feeding of Crops and Stock."

Climate and Clothing.

The authorities collected in the "Welcome Tropical Research Laboratories Review," incline to the view that the ills of tropical life are not due to the sun's actinic rays, and that therefore it is useless to devise clothing suitable for excluding these. Body temperature is intimately connected with the amount of water in the body and its excretion from it and a hot moist temperature increases the amount of water and therefore heat production. Excess of water causes (1) intermittent pyrexia, (2) increased blood destruction, (3) abnormal forms of corpuscles, (4) increased pigment, (5) enlargement of the spleen. Acclimatisation in this respect is not possible. One result of these findings is that a "bracing" climate, so much desired by men from the tropics, "may result in their finding themselves braced into their coffins." They should avoid cold and damp, and if they are in a cold temperature it is essential that they should have plenty of sunshine. For the dysenteric, extreme cold is almost as harmful as extreme heat. Recently, red or black undergarments were being boomed for tropical wear, as a means of protection from actinic rays, but there is now a reaction against this theory. Tests in the Philippines indicate that the climatic effects are produced entirely by moist heat without the aid of the sun's actinic rays. The general conclusion is that for thick clothing white stuffs are always the best, and also for thin clothing if it fits tightly to the body, but that if loose a dark colour is best because the heat absorbed by the stuff does not warm the body by contact. The best clothing is one of loose stuff, with large sleeves and easy at the neck. When the sun is very strong it should be of light exterior and dark inside. It is a mistake to aim at light weight of clothes; thick reps and drills are superior to thin materials.

—The Colonial Office Journal, June, 1913.

The Model Gardens.

Record of Attendances.

Below is given a table, arranged in quarterly periods, setting out the number of pupils who attended the Model Gardens of the colony from April 1, 1907. These quarters (recorded below as 1st, 2nd, 3rd and 4th) run from January 1 to March 31; April 1 to June 30; July 1 to September 30; and October 1 to December 31. The totals only during 1907, 1908 and 1909 are given; the records since then are in detail.

Quarters.	Bourda.	Charlestown.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	La Grange, W. Bank, Dem.	Suddie, Essequibo.	Den Amstel.	Houston, E. B.	Wakenaam.	Total Attendances.
1907.										
2nd to 4th	1,261	928	994	835	556	...	...	...	...	4,574
1908.										
1st to 4th	5,447	3,386	1,477	887	1,053	160	...	...	...	12,410
1909.										
1st to 4th	6,473	2,665	1,738	1,277	1,192	1,897	662	...	...	16,904
1910.										
First	1,282	769	287	370	259	489	465	..	...	3,921
Second	1,311	558	787	894	303	455	519	403§	...	5,240
Third	¶1,234	526	910	748	294	510	498	537	...	5,257
Fourth	1,209	444	1,285	336	295	493	502	592	...	5,156
1911.										
First	1,086	360	1,042	838	312	514	414	572	577	5,695
Second	1,263	326	713	816	286	292	536	591	688	5,511
Third	¶1,093	385	910	627	361	297	543	441	639	5,296
Fourth	1,687	448	935	588	447	406	737	957	540	6,745
1912.										
First	1,127	379	1,374	1,034	425	207	573	359	423	5,901
Second	1,385	359	1,096	900	484	553	730	461	413	6,381
Third	1,416	400	763	889	412	572	621	616	443	6,132
Fourth	1,586	254	1,162	479	459	768	620	720	439	6,487
1913.										
First	1,613	464	1,060	637	529	764	661	464	342	6,534
Second	1,273	498	1,368	863	517	766	653	508	401	6,847

Note.—The figures for the Country Model Gardens quoted above refer only to the numbers present during instruction given by the Superintendent Teacher. It has not yet been found feasible to keep reliable, full records of the very numerous attendances during his absence.

¶ Schools in vacation during August.

‖ Instruction commenced in July.
§ Instruction commenced in April.

Answers to Correspondents.

S. H. B. (Onderneeming).—The parasites you obtained from the pupa of *Brassolis sophorœ* belong to the Hymenoptera family *Chalcididae*, their specific name being *Chalcis annulata*, F. This is the first record of a parasite of *Brassolis sophorœ* in British Guiana.

S. H. B. (Onderneeming).—The beetles you obtained from the Coconut Palm were the well known Palm Weevil, *Rhyncophorus palmarum* L. This insect also breeds in sugar cane.

E. BECKETT. (Berbice).—Insects received. 16 Diptera: 14 Coleoptera: 20 Hymenoptera: 12 Homoptera.

S. H. B. (Onderneeming).—Insects received. 18 Lepidoptera.

DODDS (Essequibo).—The insects you sent attacking sugar cane belong to the Coccidæ:—*Orthezia insignis*, Douglas.

GRANTHAM (Berbice).—The specimen you obtained from a 'Tiger Fish' is a Crustacean and belongs to the Argulidæ or 'fish lice.'

Formalin for Typhoid Flies.

A simple method of destroying house flies, which is well spoken of, is described in *The Agricultural Journal* of Queensland. Formalin is the agent employed. Once ounce of commercial (40 per cent.) formalin is added to one pint of equal parts milk and water. A trace of sugar added makes it more attractive. The mixture is exposed in shallow plates, and a piece of bread or blotting-paper in each plate offers more space for the flies to alight on. The preparation has been tried in cow houses, stables, dairies, and dwelling houses, and in most cases seems to have been very destructive. Mixed with syrup it was eaten by ants with impunity.

—Journal of Agriculture, Victoria, Australia,
November 11, 1912.

Exports of Agricultural and Forest Products.

Below will be found a list of the Agricultural and Forest products of the colony exported this year up to June 30th, 1913. The corresponding figures for the three previous years are added for convenience of comparison :—

Product.	1910.	1911.	1912.	1913.
Sugar, tons ...	30,262	30,368	21,451	22,349
Rum, gallons ...	884,000	671,468	1,199,033	1,428,085
Molasses, casks ...	454	437	906	575
Cattle-food, tons ...	3,382	2,461	2,407	4,690
Cacao, cwts. ...	253	159	102	9
Citrate of Lime, cwts.	57	25	43	...
Coconuts, thousands	455	472	874	460
Copra, cwts. ...	141	746	913	620
Coffee, cwts. ...	978	685	1,050	647
Cotton, lbs. ...	...	...	...	...
Fruit, brls. and crates	...	...	...	...
Ground Provisions, value	$414 32	...	...	...
Kola-nuts, cwts. ...	9	...	...	...
Rice, tons ...	3,588	1,446	2,064	3,338
Rice-meal, tons ...	811	491	1,107	1,087
Starch, cwts. ...	4	...	...	...
Cattle, head ...	584	472	314	338
Hides, No. ...	2,881	2,201	1,880	2,421
Pigs, No. ...	444	509	687	942
Poultry, value... ...	$ 62 76	...	...	...
Sheep, head ...	69	21	39	18
Balata, cwts. ...	2,041	1,670	316	2,300
Charcoal, bags ...	39,028	38,130	37,825	28,694
Firewood, Wallaba, etc., tons ...	5,267	5,893	5,290	4,312
Gums, lbs. ...	759	2,518	2,425	1,515
Lumber, feet ...	106,603	243,085	99,550	292,233
Railway Sleepers, No.	500	2,020	3,876	1,503
Rubber, cwts. ...	7	17	1.3	.7
Shingles, thousands	981	1,473	819	1,269
Timber, cubic feet	181,813	127,706	163,261	222,929

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Difficulties of Agricultural Development.

In these days we read and hear a great deal about the possibilities of the development and expansion of agriculture in British Guiana. Indeed from the view-point of soils, areas, and climatic conditions every prospect pleases but unfortunately these are by no means the only essentials in successful agriculture.

It is a recognized fact that the agriculturist himself must be an individual possessed of some measure of energy and intellectuality, for success in his profession and of the profession itself depends on their presence in some degree. By intellectuality is understood the power of being able to deal intelligently with the innumerable problems invariably presented by any scheme of cultivation however small and energy is an absolute necessity both in the mental processes and in the actual execution of the work itself.

Bearing in mind these considerations it ceases to be a matter of surprise why the native cultivator of this colony has in the past so signally failed to develop in any extent some appreciable area of the enormous tracts of fertile land which lie easily within his reach. In substantiating this statement no better example can be given than the manner in which the presence of numerous insect pests and plant diseases are regarded.

Practically every crop that is raised in British Guiana suffers from the ravages either of some injurious insect or fungus, and it is a notorious fact that our farmers are quite content to stand by and apathetically witness either a serious reduction or the complete destruction of what in many cases comprises their only legitimate source of subsistence. This is not due to the absence of advice as to the best steps that should be taken to alleviate such attacks or to guard against them in the future, for this assistance is at all times readily available.

As a specific instance may be quoted the regular defoliation of Coconut Palms in all parts of the colony and more especially in and about Georgetown (the intellectual centre of British Guiana) by the caterpillars of *Brassolis sophorœ*. Palms thus attacked present a most deplorable and unsightly spectacle not to mention the entire loss of a crop of nuts. For a number of years the method of dealing with this pest has been made widely known by means of printed notices and direct advice. These remedial measures are extraordinarily simple and consist in ascending the tree and removing those branches holding the nests which are constructed by the caterpillars in which they hide during the daytime coming out at night to feed. Notwithstanding this the defoliation occurs at regular intervals and no steps are taken to deal with it. Occasionally however an individual is encountered who has made some effort to control the attack but his attempts have proved abortive owing to reinfestation from his neighbour's cultivation. This is only one of numerous instances that could be given but is quoted here as being perhaps the most flagrant.

Compulsory sanitary measures now exist in every civilized country of the world and compulsory plant sanitation is also appearing in some places, notably the United States of America. In British Guiana such legislation is a crying necessity as it is the only really efficacious method of dealing with insect pests and plant diseases.

In conclusion we may quote the following extract from an Official Report on the Locust invasion which occurred in Berbice in 1886, incidentally it is entirely characteristic of the mental attitude of our farmers of to-day :—"A striking feature in the locust area is the apathy of the farmers whose provision grounds are being destroyed. They have made no attempt to catch any locusts nor to destroy their eggs. If a live locust be

taken up by them, they will again drop it down alive though their crops are suffering from the ravages of the insects. They, in answer to a recommendation to destroy at least some of the locusts, shake their heads and answer that they might as well try to kill mosquitoes—though individual insects are not hard to catch and the eggs are easily found. A more pertinent answer was sometimes given when they replied that their crops being destroyed, how were they to live if they spent their time catching locusts for nothing. Yet they and their families in their spare time might do a great deal in destroying the insects and eggs."

National Diploma in Horticulture.

It has long been felt desirable in horticultural circles that some diploma should be available for professional gardeners, the holding of which should be an indication of real professional ability. In 1912 the Council of the Royal Horticultural Society accordingly approached the Board of Agriculture on the subject, with the result that the approval of the Board was given to the proposal, and authority was given for the diploma to carry the title "National."

The examinations for the National Diploma in Horticulture are open to men and women, and will, as far as possible, be held in the later part of June each year. Candidates will be required to register themselves with the Royal Horticultural Society and to pass two examinations, a preliminary and a final. The first examination will be held in June, 1914, and those desiring to enter should at once make application to the Secretary of the Royal Horticultural Society, Vincent Square, Westminster, S.W., for the syllabus.

Among those for whose benefit the Diploma is established are the following:—Florists, fruit-growers, gardeners, market gardeners, nurserymen, public park gardeners and seedsmen.

Horticulture is defined as being a definite craft of itself and not a department of agriculture, and as including the more intensive cultivation (as usually practised in gardens) of fruit, vegetables, flowers, shrubs and ornamental trees.

—"Journal of the Board of Agriculture" of England.

Notes on some of the more Common Diseases of Poultry.

By S. H. Bayley, Superintendent, Onderneeming Farm.

SEVERAL poultry keepers in different parts of the Colony having recently written asking advice as to treating sick birds, it has been suggested that some notes on the more common diseases to which fowls in the Colony are liable together with hints as to treatment may prove useful. With the object therefore of possibly helping some readers of the Journal these notes are written. The remedy suggested in each case is the one which practical experience at the Onderneeming Farm has proved most efficacious, combined with symplicity.

It is to be understood that no claim for originality of treatment is made. The writer has during the past 8 years had considerable experience with sick fowls, while he has also had at hand a large number of works by recognised authorities on Diseases of Poultry, as a result many and various remedies for different diseases have from time to time been tried, the treatment suggested in the following notes being in each case the one which has appeared to give the best results.

WORMS.

Most people are aware of the ravages of worms in horses, cattle, sheep and swine but it does not appear to occur to many poultry keepers that they suffer loss through intestinal worms in their fowls. Both round and tape worms find a home in poultry, they keep the birds poor and reduce egg production.

"Home Doctoring of Animals" by H. Leeney, M.R.C.V.S., recommends that fowls should be treated twice a year for these parasites. Leeney's treatment, which has been tried at this farm with excellent results, is very simple. Shut up the fowls without any food, but with a liberal supply of pure water from night until 1 p.m. next day; then on the empty crop give each bird a pill composed of 1 grain Santonine, 1 grain Calomel and 10 grains of powdered or grated Areca nut. Feed three hours later on light and green food. The droppings should be carefully collected and burnt, an examination of them will reveal an astonishing number of worms.

GAPES.

This disease is due to the presence of a thread worm (Syngamus trachealis) in the wind-pipe. It is chiefly caused by fowls drinking filthy stagnant pond water. The disease is easily recognisable, and our experience at this farm has been that it is easily cured.

Birds attacked are observed to stand in a dooping posture, stretch out their necks and open their bills and gape or yawn, then the gullet is worked as though the bird were swallowing or endeavouring to swallow something. This gaping or yawning goes on almost incessantly about once a minute.

Of the several remedies suggested by different authorities we have found the following by far the simplest and surest :—

Let an attendant hold the bird and open its beak so that you can see the opening of the windpipe. Take some wing feathers and strip them leaving only an inch of feathers at the tip. Dip one of these feathers in turpentine, give it a shake, and put it gently down into the throat and twirl it round three or four times *quickly* and withdraw suddenly. Give the bird a chance to breathe, then take a second feather, dry this time, and repeat the operation. Take a third feather now, dip it in olive oil and repeat the operation once or twice. This simple operation appears to give instant relief. It should be added that as far as our observations go gapes only appear to attack chickens between the ages of one and five months.

CHICKEN POX (LOCALLY CALLED YAWS).

This disease appears to be peculiar to warm climates. Several English and American writers on poultry diseases do not mention it. It is nevertheless well known to poultry keepers in this Colony and being highly contagious causes a considerable death-rate among chickens. It seldom attacks full grown fowls. Mr. Jno. Barclay, Secretary, Jamaica Agricultural Society, in his interesting "Notes on Poultry in the West Indies" (Imperial Department of Agricultnre, Pamphlet series No. 23) attributes this disease to uncleanliness, overcrowding, and want of proper ventilation ; and as a first remedy he emphasises the necessity for removing the cause, *i.e.*, scrupulous cleanliness and attention to hygienic principles.

Coops should be cleaned every day and he recommends that the floor be sprinkled with fine earth and sand mixed with a

little lime. He adds that the chickens should have a dose of Epsom salts—one teaspoonful of salts mixed with soft food will do for a dozen two weeks old chickens; two teaspoonful for a dozen chicks 3 to 4 weeks old, and a good dessert-spoonful to a dozen chicks 5 or 6 weeks old, the dose to be increased as they grow older. When a poultry keeper observes little pustules or boils about the heads of some of his chickens and suspects that he has yaws in his runs, he would be well advised to isolate all infected broods, carefully follow Mr. Barclay's advice as to cleanliness in all coops not infected, and examine his chickens daily; removing all suspects to the isolated area. With early and careful treatment this disease may be got rid of without great loss. Painting the sores with carbolic acid, iodine, a solution of potassium permanganate, etc., etc., has been recommended, but the treatment which has given best results at this farm has been :—

Wash the sores with warm water, then bruise them, or pick off scabs, and rub in tobacco and lime juice mixture, daily. Threepenny worth of strong common tobacco should be steeped in ½ pint of boiling water and when cool an equal quantity of lime juice added. The white-washing of all coops is also recommended. This disease generally makes its appearance during the hot dry months of the year.

ROUP.

Roup is a more serious disease than any that has so far been mentioned. Just as Pox or Yaws appears during the hot months, so the wet damp months seem to be favourable to Roup. The disease which appears to start with a cold is highly contagious, and is chiefly communicated by the medium of the drinking trough, the necessity for segregation of sick birds is is therefore apparent. One sick bird is stated to be capable of infecting a whole flock.

The first symptoms of Roup are watery eyes, running from the nose, and a rattling sound in the throat, somewhat like snoring, as the bird breathes. This last named is a most reliable symptom. Later a yellow offensive deposit is found in the mouth, and the eyes get covered with a yellow, sticky matter, which, if neglected, becomes hard adhering to the eye ball and covering it completely. Our experieuce has been that if taken early this disease is curable, but when all the later symptoms have become thoroughly established it is better to destroy the bird and burn the carcass.

The treatment which has met with the greatest success at this farm is as follows :—

Isolate affected birds and disinfect all fowl houses and coops by means of white-wash to which a little carbolic acid has been added. Thoroughly cleanse all drinking and feeding troughs. The affected birds should be given a little aperient—a little Epson salts. The nostrils should be syringed twice a day with 5% carbolic lotion, in the morning and at 3 o'clock in the afternoon as it is inadvisable to run the risk of leaving the birds' head wet just before they settle for the night. It is a good plan to hold the bird up by its legs before syringing when with the aid of a little pressure of the finger much of the nasal discharge may be run off into a bowl of disinfectant. The eyes and mouth should also be washed with the carbolic lotion at the time of syringing. To clean the mouth use a little bit of rag on the end of a stick. Feed on a nourishing but light diet, bread and milk, cornmeal and boiled food. Give a 2 grain quinine pill night and morning, and put a lump of camphor in the drinking water.

COLD (CATARRH).

Running at the eyes and nose, droopy wings, ruffled feathers and general dullness are symptoms of a cold. Birds should receive immediate attention because there seems to be much evidence to support the theory that Roup may develop from a cold ; indeed F. C. Elford, Chief of the Poultry Division, Department of Agriculture, Ottawa, in his paper on the Diseases and Parasites of Poultry, gives as the cause of Roup "planted by only a neglected slight cold."

Treatment.—Sponge the eyes with equal parts of vinegar and water, syringe the nose with 5% carbolic lotion ; give a daily pill of 1 or 2 grains of quinine according to the size of the bird. Put a lump of camphor and a couple of old rusty nails in the drinking water.

WHITE COMB (FAVUS).

The disease may be detected by small white spots coming on the comb ; if neglected, they gradually spread and cover the whole comb, and extend down the neck causing the feathers to come off. It is stated to be due to the same fungus which causes one form of ringworm in mammals. White comb is contagious and should be treated accordingly.

Give a dose of Epsom salts and feed chiefly on soft food. Rub the affected parts with a mixture of two parts—by weight—of turmeric and 1 part of coconut oil. This treatment has proved very successful at Onderneeming.

SCABY LEG

This is a parasitic disease ; a form of mange. Scrub the legs thoroughly every morning with a hard brush, using soap and water in which washing soda has been dissolved. After drying the legs rub them over with sulphur ointment. A cure should be effected within 5 or 6 days.

LEG WEAKNESS.

It has been our experience that this complaint is very easily mistaken for cramp. It is usually found among *cockerels* of the heavier breeds, and is stated to be caused either by wrong feeding, too rapid growth or breeding from weakly parents. Change the food and the system of feeding ; so that the bird has a plentiful supply of lime, old mortar and crushed shells ; and give sulphate of iron in drinking water—¼ oz. sulphate of iron in 2 pints of water.

CRAMP.

Cramp is caused by exposure to wet and this is preventable. It is however sometimes caused by sudden change of weather. The legs of the fowl appear to stiffen and it cannot walk. Give a little warm milk or brandy or whisky, or a few drops of essence of ginger. Rub the legs with turpentine, or if no turpentine is at hand, with lime juice, then wrap them up in flannel. Make the bird cosy in a box with straw. Note that the legs include thighs which especially should be well rubbed.

DIARRHŒA.

Many poultry keepers do not pay any attention to this complaint, but presistent looseness of the bowels should always be regarded as of importance ; not only is it very weakening, but it may indicate other things. Birds should be isolated, given a dose of castor oil and after this has acted a dose of 20 grains of compound chalk powder night and morning for a couple of days. Feed on boiled rice and bread and milk.

GENERAL.

" Prevention is better than cure " is a motto especially applicable to poultry and their diseases. Every authority on

the subject emphasises this. The moment a bird is seen to be ill it should be removed from among the others and treated by itself.

The necessity for scrupulous cleanliness cannot be too greatly accentuated.

" Home Doctoring of Animals " (Harold Leeney, M.R.C.V.S.), says " The diseases of poultry are for the most part infectious, and nearly all are due to want of thorough cleanliness. One might repeat Lord Beaconfield's parody and say that the prevention and cure of them are to be summed up in the sentence " Sanitas sanitatis, omnia sanitas."

Banana Juice as a Cure for Snake Bite.

A correspondent has forwarded us the accompanying extract from 'The Over-Seas Daily Mail,' indicating a remedy for snake-bite which is simplicity itself, and one within the reach of all living and working on our coast lands. Whatever may be the properties of the juice of the stem of the banana plant it would seem from the newspaper extract that it has something in its composition which destroys the snake-poison. The alleged cures are certified by Mr. W. N. Weston, a resident of Matto Grosso, Brazil, as follows:—

I have witnessed some remarkable cures of bites from poisonous snakes while on a trip in the district of the Rio. Taquary. One of these was an Indian peon, who was bitten in the foot by a " Yaraoca " snake. He arrived at the Estancia, apparently in the final stages, bleeding from the gums and all swollen up. A drink of banana juice taken from the tree trunk was given him, and in three days he was quite sound.

Another case was that of a child who was treated in the same way and recovered. I also saw the case of a bullock which was snake-bitten and seem to be dying, unable to get up. We made an experiment by forcing it to swallow the juice. The swelling subsided, and next day the bullock was almost sound and able to graze.

There is no doubt it is a wonderful remedy, and I would be interested if any of our readers have heard of it and could tell me what properties the juice contains.

—" Queensland Agricultural Journal."

Entomological Notes.

Froghopper Determination.

We have recently received from Mr. F. W. Urich, Entomologist to the Board of Agriculture, Trinidad, his determination of the Froghopper which is frequently met with here on sugar-cane, rice, and certain grasses. He names it *Tomaspis flavilatera*. Urich, and the description is shortly to be published through the Imperial Bureau of Entomology.

Plant Bugs on Hevea brasiliensis.

On several plantations recently the Pentatomid Bug, *Empicoris variolosus* L. has been observed in considerable numbers. During the day they hide themselves in depressions of the bark, old tapping wounds, etc., and are in this position often difficult to detect. It is supposed, though no actual evidence has yet been produced in support, that they cause exudation of the latex from young green shoots by piercing them with their mouth parts. The matter is receiving investigation.

Froghopper Control.

We have recently received from the Board of Agriculture of Trinidad and Tobago two circulars Nos. 9 and 11 entitled respectively "The Froghopper Egg Parasite and its Colonization in the Cane-fields" and "The Sugar-cane Froghopper and Biological Notes on some Cercopids of Trinidad," both are by Mr. F. W. Urich, Entomologist of the Board.

Circular No. 9 gives a complete life-history of the *Tomapis varia*. Fabr. together with an exhaustive account of the various methods of control now in use in Trinidad. Three magnificent coloured plates together with numerous photographs and diagrams accompany this publication. Circular No. 11 gives a detailed account of the life-history of *Oligostia girault*i. *Cwfd.*

Both circulars are a distinctly valuable addition to our knowledge of these destructive insects and their natural enemies.

Cowflies and Disease.

In other countries it is a proven fact that cowflies (known scientifically as *Tabanidae*) are the transmitters of several deadly veterinary diseases which affect cattle, horses, mules, sheep, etc. The following list of *Tabanidae*, captured while actually attacking mules, has been compiled from the records of the Entomological collection in this Laboratory, and will be found of interest in connection with the recent outbreak of *Mal de Caderas* amongst plantation mules in Berbice. This disease is supposed (though no proof has been yet forthcoming here or elsewhere) to be transmitted by means of biting flies from wild to domestic animals.

The identifications were made by the Director of the Imperial Bureau of Entomology and experts in the United States National Museum.

Tabanus impressus. Wied.
Tabanus semisordidus. Walk.
Tabanus trilineatus. Latr.
Tabanus caiennensis. Fabr.
Tabanus desertus. Walk.
Chrysops tristis. Fabr.
Chrysops costata. Fabr.

An Insect destructive to the Seeds of the West African Oil Palm in B. Guiana.

Attempts have recently been made to germinate the seeds of the West African Oil Palm as grown in British Guiana. These attempts proved to be almost an absolute failure owing to the fact that almost every seed was found to be infested by the larva of a Bruchid Weevil which in the course of its growth destroys the entire kernel. Infestation of the seeds takes place probably as follows :—The seeds while on the tree have a fleshy covering which in the process of ripening becomes a reddish colour and is usually gnawed off, wherever exposed by bats.

The seeds eventually falls to the ground and the female adult insect then deposits it egg within the micropyle or small hole through which the embryonic shoot appears. On emergence from the egg the young larva makes it way down through the micropyle to the kernel where it remains and feeds till mature.

The perfect insect emerges through a perfectly circular hole neatly bored through the hard shell and just large enough to allow of its exit.

Of the seeds picked up and examined at the base of these palms growing in the Botanic Gardens fully 80 per cent. were found to be infested.

By removing the seeds from the palm before they fall to the ground infestation should to a very great extent be avoided.

Parasites of *Calpodes Ethlius*—Cramer.

THIS Hesperid Butterfly commonly attacks Canna Plants grown for ornamental purposes throughout British Guiana. Its method of attack is to roll up the edge of a leaf and from this hiding place it issues forth preferably at night to feed.

A number of the eggs, larvæ and pupæ of this insect were recently collected and brought into the laboratory for breeding purposes but the specimens were found to be so heavily parasitized that only one adult butterfly was obtained. Thus one species of egg parasite, two species of larval parasites, and one species of pupal parasite were obtained.

From one Calpodes larva no less than 851 adult parasites of one species emerged, and from another larva 67 parasites of a different species. Fourteen of the pupal parasites emerged while a single parasite only emerged from each egg. None of these insects are as yet determined. *Calpodes ethilus* is known also as a pest in the United States where the eggs are attacked by *Penturthron minutum.** Riley.

The Utility of a small Native Bee.

THERE is a small bee in British Guiana which may be found nesting in hollow Courida trees and which by experiment has been found to thrive under artificial conditions and give a relatively excellent yield of by no means inferior honey.

The nests when discovered may be removed from the Courida trees and placed in ordinary wooden boxes of a convenient size. All crevices around the lid are securely stopped

(* Circular 145. Bureau of Entomology. United States Department of Agriculture).

up with clay and a small exit hole is provided in the side of the box which should be kept sheltered from the rain.

These bees, which are entirely stingless, soon become accustomed to their new home and require no attention except when swarming or when the honey is to be removed.

The scientific name of the insect is at present unknown but specimens have been forwarded to the Director of the Imperial Bureau of Entomology for identification.

A nest of these bees has been procured and has been successfully kept in the centre of Georgetown for observation purposes. We are indebted to Mr. de Groot, the manager of Pln. Bath, Berbice, as the source of this note.

—G. E. B.

Susceptibility of Plants to Disease.

Susceptibility to mildew and yellow rust in wheat, and to mildew in barley, is increased by providing the plants with large amounts of available nitrogen: ammonium sulphate and sodium nitrate seem to be equally effective in this direction.

Mineral manures, especially potash salts on the contrary decrease the susceptibility to disease but cannot counteract the effect of large quantities of nitrogenous manures.

Plants which are semi-starved as regards nitrogen exhibit a considerable degree of immunity, even if the phosphates and potash are also present only in small quantities.

Lithium salts are also effective in producing immunity, while nitrates of lead and zinc, particularly the latter, render plants extremely susceptible. Other salts of lead and zinc have very little effect on the susceptibility of plants.

A variety of wheat which is almost immune to a disease (such as Little Joss to yellow rust) tends to retain its immunity even when supplied with excess of nitrogenous food-material.

Increased immunity does not appear to be due to a lack of food material available for the fungus in the host, as suggested by M. Ward, because the plants rendered relatively immune by adding phosphates or potash to their food-supply were as healthy and well-grown as those receiving no such additions.

It yet remains to be seen what physiological explanation can be found to account for the changes in susceptibility which can be produced in plants by the above means.

—G. T. Spinks in the "Journal of Agricultural Science."

Meeting of the Board of Agriculture.

A MEETING of the Board of Agriculture was held on 30th September, 1913, Professor J. B. Harrison, C.M.G., chairman, presiding with the Hon. F. Fowler and Messrs. C. K. Bancroft (Deputy chairman), J. J. Quelch, B. Gainfort, A. Seton Milne W. C. Shankland, O. Weber, S. H. Bayley, J. Gillespie, T. Earle, G. E. Bodkin, W. M. B. Shields and E. S. Christiani (Secretary) in attendance.

The arrival in the colony since the last meeting of the Board of Mr. C. K. Bancroft, was reported by the Chairman. As this was the first meeting at which Mr. Bancroft was present Professor Harrison said that the members would welcome him and were certain that he would prove of the greatest assistance to the Board as well as to the colony. The special study of the cultivation of Para Rubber which Mr. Bancroft had made in the East would prove of great help to cultivators of rubber in this colony.

The resignation of Messrs. J. Wood Davis and C. P. Gaskin as members were announced.

An expression of regret on the part of the Board was moved by the Chairman at their deprivation of Mr. Gaskin's services. Mr. Gaskin was one of the original members and a regular and keen attendant to business, more especially when it related to Berbice and Live Stock.

On Mr. Earle seconding the regret of the Board was placed on record.

Unanimous approval was expressed at the re-appointment of Mr. J. J. Quelch, and mention was also made of the appointment of Mr. Shankland, and the granting of leave of absence to Mr. W. M. Hodgson, Mr. A. Leechman, and to the Government Veterinary Surgeon on account of his ill-health which had rendered him incapable of performing his duties to the satisfaction of the Board. The return from leave of Mr. B. Gainfort was also noted.

The Chairman reported that the West Bank Farmers' Association and the Buxton and Friendship Farming Association had been affiliated to the Board and that reports on the

Agricultural Shows recently held by these Associations would shortly be circulated to members.

AFRICAN OIL PALM.

Professor Harrison then stated that the seeds of the African Oil Palm (*Elaeis guineensis*) which had been imported by the Board on the recommendation of His Excellency the Governor had been sown, 22,840 of which up to the present had yielded only 13 plants. This, he stated, might be due either to slow germination or poor quality seeds.

Germination tests had been also made with the seeds of the local *Elaeis guineensis* but with poor success, this the Economic Biologist explained was due to the seeds being attacked by a small Bruchid Weevil which could be easily prevented. On motion of Mr. Bayley, seconded by Mr. Earle, it was agreed to import 24,000 further seeds.

The Chairman then laid on the table the published minute of His Excellency the Governor dealing with rubber plantations and the Journals of the Board for April and July were also laid. Mr. Quelch remarked that appreciation should be expressed with regard to the excellency of the Journals and of the articles they contained, it was a credit to the Board that its high degree of usefulness and instructiveness had been so well maintained.

The Chairman said that its circulation was steadily decreasing in the colony but increasing outside. He attributed this to the deplorable state of the colony's finances that so few people cared to expend eight cents a year on its purchase.

Mr. Shankland suggested that this was due to the ignorance of many people as to the existence of the journal and that he personally would be glad to do what he could to push its sale. The same willingness was expressed by a number of members and it was decided to act on it. A vote of thanks to the Editor of the Journal and its contributors was then passed.

The New By-laws regulating motor traffic in the Botanic Gardens, and a memorandum by the Economic Biologist on the control of rice caterpillars, which had been printed both in Hindustani and English and widely disseminated, were then laid over.

CENSUS OF AGRICULTURAL INDUSTRIES.

The Chairman read the census returns of Agricultural Industries for 1912–1913.

In comparison with last year there was a decrease in cane of 1,000 acres and an increase in rice of close on 6,000 acres. Coconuts showed an increase of 1,400 acres and rubber an increase of 800 acres. Limes had increased from 650 acres to 739 and ground provisions had remained about the same.

The numbers of cattle and sheep had decreased due in all probability to the drought. Goats and donkeys had increased.

REPORT ON PARA RUBBER.

A report on samples of local Para rubber by some New York experts was then read. Briefly summarised it was as follows:—

The samples received were softer than regular plantation rubber from the East and biscuits of the same quality as the samples submitted would have fetched about one dollar and the scraps ninety cents per pound.

The Chairman, in commenting on this report, remarked that these samples had been prepared from an exceedingly small quantity of latex which was very thin.

Samples of Para rubber of the finest quality from the upper reaches of the Amazon and various types of Ceylon and Malayan plantation rubber were then exhibited.

A letter of appreciation was read from Sir Daniel Morris, the late Imperial Commissioner of Agriculture for the West Indies, in acknowledgment of a resolution previously passed by the Board appreciating his services to Tropical Agriculture.

LIGNITE DEPOSITS.

The Chairman exhibited a specimen of lignite from Yaruni, about 50 miles up the Demerara River, which he had recently had the opportunity of inspecting. He stated that it was tertiary lignite and contained from 40 to 45 per cent. of water when procured, and consequently in this state was not a good fuel. Samples had been sent to the Imperial Institute for a report.

This same material had been met with at a depth of 280 feet while sinking the well at the D'Urban Park. He also

reported that 4 acres had been put under castor oil cultivation at Onderneeming.

RUBBER CULTIVATION AT BONASIKA.

In this connection it was decided that His Excellency the Governor should be approached, and his permission obtained, to close down this cultivation as the work which it had been intended to carry out there was finished and the expense of maintaining the station was exorbitant.

Professor Harrison then stated that Mr. Bancroft had undertaken experiments in the bleeding of balata trees as suggested by His Excellency the Governor before Mr. Bancroft's arrival in the colony, and moved that the expense of the experiments should be charged against the "Contingencies" vote of the Board. Mr. Gillespie seconded the motion which was consequently carried.

RICE CULTIVATION AT D'URBAN PARK.

The Chairman stated that as His Excellency was desirous of testing whether the water from the recently bored Artesian Well could be utilized for the growing of rice, a small area of rice had been started near the well. It was then decided to charge the cost of this experiment to the Board's "Contingencies" vote.

THE FORMATION OF A BERBICE COMMITTEE.

Professor Harrison then narrated some experiences he had recently had while on a trip up the Berbice River, in regard to the agriculture of that district. At the same time he had been impressed by the fact that the Board was not in sufficiently close touch with this county and the formation of a Berbice sub-committee had been suggested consisting of the following members :—Hon. J. Downer, Messrs. B. Gainfort, W. M. B. Shields and W. C. Shankland.

The Chairman moved the appointment, and Mr. Earle seconded, and the motion was carried.

Mr. Gainfort was appointed convener and Mr. Augustus, Agricultural Instructor, Secretary.

Mr. Bayley then raised the question of the possibilities of holding an Agricultural Show in Essequibo. After considerable discussion it was at last decided that the Government should be asked to put $600 on the estimates for this purpose.

The Chairman reported several restrictions which had been made on the authority of the Attorney General in the regula-

tions regarding the issuing of licences to shoot wild birds, and the licences to export Bird Skins.

Thus the birds on several estates on the Essequibo River had been protected, and that in exporting birds skins they would first be examined by the Economic Biologist who would only allow such numbers to be exported as he regarded as proper. This was done to prevent individuals from shooting a large number of birds of the same species as had been recently occurring. Both these actions were approved of by the Board and they also decided that after the skins had been examined the box should be sealed up and the Customs notified accordingly.

VETERINARY MATTERS.

The destruction of a mare suffering from advanced glanders was reported. The animal had been discovered on the public road, but through the neglect of the Board's Officer the owner had been only reprimanded when a much severer penalty should have been imposed.

A disease which had recently broken out amongst mules on a number of the Berbice sugar estates was then discussed. Professor Harrison told the members that it was at first thought to be Cerebo-spinal Meningitis but as considerable dissatisfaction was displayed in certain quarters at this diagnosis they were obliged to obtain the services of the Assistant Government Bacteriologist to investigate the disease.

This officer succeeded in obtaining almost identical results as Captain Farrant, the well-known Berbice Veterinary authority, and eventually both were unanimous in diagnosing it as Mal de Caderas, a South American equine disease.

The disease had been added to the list of contagious diseases and certain areas had been declared to be infected.

A letter had been drafted dealing with the disease which would be sent to all concerned and posters would be exhibited in conspicuous places.

A vote of thanks to Capt. Farrant and the Assistant Government Bacteriologist for their services was then carried and also to the Surgeon General for allowing the Board the Bacteriologist's services.

The annual inspection of the Experimental Fields was fixed for Monday, October 13th, at 2 p.m.

The Inspection of the Experimental Fields.

As arranged at the previously held meeting of the Board of Agriculture, an inspection was made of the Experimental Fields on Monday, October 13th, by the following members.

Professor J. B. Harrison, Messrs. C. K. Bancroft, H. L. Humphrys, A. Seton Milne, W. M. Payne, Frank Fowler, Thomas Earle, G. E. Bodkin, R. Ward, J. F. Waby and E. S. Christiani. Apologies were received from a number of members for their unavoidable absence.

Inspection was first made of the herbarium and the nurseries where a number of recent improvements were noticed.

A move was then made to the Brickdam Experimental Field where the canes and cotton were examined; considerable interest was here displayed by the planting element in a fine plot of Green Transparent cane.

The artesian well recently bored at the D'Urban Park was then investigated and keen interest was shown in the quality and quantity of the flow of water.

The rice beds which had been laid out at a short distance from the well and irrigated from thence were inspected, and comment made on the various yields noticeable.

The cattle byres were then inspected and the stock recently imported by the Board were admired.

The main Experimental Rice Field was next visited and the numerous varieties of rices there grown discussed; inspection was afterwards made of the Eastern Section of the Cane-fields, and also the fruit walk.

The sheds containing the alcohol engine and a small plant for crushing canes for experimental purposes were then examined and later light refreshments were partaken of.

Mr. Maynard Payne, as the senior unofficial member present, then made a short speech in which he heartily congratulated Professor Harrison and his staff on the excellent work which they were doing, and he was sure that the other unofficial members would agree with what he said.

Continuing the tour of inspection, the North-Eastern field was examined where a number of varieties of canes and coconuts were seen and also a number of recently imported rices principally from Java and India.

The meeting was concluded by a visit to the ornamental lakes which were gradually being connected up by canals so as to promote a constant flow of water which, it was hoped, would considerably minimize the breeding of mosquitoes.

The Giant Hevea.

In the Acre territory it is said, there is a specimen of the *Hevea brasiliensis* which measures 25 ft. in circumference. This tree holds the record of the Amazon Valley, both for size and yield. It is reported to give a revenue of about £432 a year, and is the sole support of a family of seven but this is probably an exaggeration, as with rubber at 3s. a lb. £432 a year represents an output of nearly 3,000 lb.—a tall order ! The Rubber Defence superintendent has ordered it to be photographed with the family assembled beneath it.

—"The Rubber World."

Fourth International Rubber Exhibition.

The authorities have issued a first edition of the prospectus of this great Exhibition which is fixed for June, 1914 in London. With the rubber display will be associated cotton, fibres and other tropical products, so that the result should be a more or less complete tropical planting exposition.

The exhibition will remain open from the 24th June, during that time the International Congress of Tropical Agriculture will also be sitting.

A section is to be devoted to Palms and Palm Products and this should prove one of the most interesting displays.

The available space for the exhibition covers an area of over 200,000 square feet.

Experiments with Varieties of Rice at the Botanic Gardens, 1913.

By Professor J. B. Harrison, M.A., C.M.G., Director of Science and Agriculture, and R. Ward, Agricultural Superintendent.

EXPERIMENTS with local and imported kinds of rice were continued during 1913 at the Experimental Fields, Botanic Gardens, with the following results :—

Selected Varieties.	Bags (120 lbs.) of Padi per acre.
Creole	49.7
No. 6	45.8
No. 75	47.7
Variants.	
No. 75. Var. 1	52.1
,, ,, ,, 4	50.2
,, ,, ,, 5	52.1
,, ,, ,, 6	49.7
,, ,, ,, 7	51.2
,, ,, ,, 8	53.1
,, 6 ,, 1	48.2
Creole ,, 1	46.5

Taking the series of nine years (1905–13, inclusive) during which these trials with the selected varieties have lasted with the mean results have been as follows :—

Kinds of Rice.	Bags (120 lbs.) of padi per acre.	Creole taken as 100.
No. 6	38.9	105.1
No. 75	37.9	102.4
Creole	37.	100.0

The large scale trials—on ½ acre plots—of the variants did not result in the relatively high yields obtained from them on smaller plots during 1911.

But several of these 75 Variants No. 1, 4, 5, 7 and 8 and No. 6 Var. 1 gave higher results than did the rices they were selected from.

THE EFFECTS OF SULPHATE OF AMMONIA.

Twenty-six 1/8th acre plots were cross-dressed with sulphate of ammonia whilst 26 plots (their duplicates) did not receive any nitrogenous manurings. The returns on 16 of the plots not receiving nitrogenous manure were higher than were those from the corresponding cross-dressed plots: on 9 plots the returns from the cross-dressed plots were higher than those from the non-manured whilst on one the returns were the same on both cross-dressed and not cross-dressed plots.

The mean results of the twenty-six duplicate plots show that 48 bags per acre were obtained where sulphate of ammonia was used as compared with 49.5 bags per acre where it was not applied The rice was in every case heavily laid. The period during which the rice-field was in fallow had resulted in an accumulation of available nitrogen in the soil sufficient, and (from the appearance of the field crop) more than sufficient, for the needs of the rice-crops. The nitrogen added merely increased the luxuriance of growth of the stems of the plants with the sacrifice of some of their rigidity thus causing the rice to be early laid and tending to retard the proper maturation of the grains. Previous trials had shown that this was due to excess of nitrogen and not to a deficiency in the soil of available phosphates and potash. The general falling of the rice irrespective of whether or not it had been manured with sulphate of Ammonia has been due to the accumulation of nitrogen in the soil and to exceptionally heavy crops resultant therefrom.

The 'Mechanical Experiment' and its Results.

The doing of fixed experiments in fixed hours does not entail the exercise of investigative faculties other than those of the most mechanical nature. The student receives instructions as to the setting up of apparatus and the preparation of his material. If he follows these faithfully and accurately he is reasonably certain of gathering the data for the necessary conclusions. Perhaps from his primary deductions he is required to generalize some governing principle of the widest application. At best he has had almost no chance for the use of his imagination; he has never learned the meaning of high scientific accuracy. He has no true notion of the difficulty of putting a problem on a working basis. I believe it must be the lack of just such powers which leads to the adverse criticism of so many American students in German universities.

—"Science," November 29, 1912.

A New Insect Pest of Coconut Palms in British Guiana.

CASTNIA DAEDALUS. CRAMER.

By G. E. Bodkin, B.A., Dip. Agric. (Cantab.), F.Z.S., F.E.S., Government Economic Biologist.

HISTORY AND DISTRIBUTION.

THE adult moth of *Castnia Daedalus* has long been known to Entomologists and is mentioned in all monographs and papers dealing with the family *Castniidae.*

But little is known, however, of the larvæ or breeding habits of these insects and to the best of our knowledge this short account of the life history of *C. daedalus* is entirely original.

According to Herbert Druce in the Biologia* this insect is common in the Guianas and Amazons valley, spreading from thence to the State of Panama where it is less abundant. It appears to be unknown in South Brazil.

In British Guiana it has been observed to be extremely prevalent breeding in Coconut Palms along the West Bank of the Demerara River and the East Bank of the Berbice River. Specimens of the adult moth have also been received from the North West District and it is probable that it occurs commonly in a number of other districts.

ECONOMIC IMPORTANCE AND METHOD OF ATTACK.

The presence of this pest in a Coconut Palm well advanced in growth is usually easily detected. In young trees, however, (those from 4-5 years in age) it is often that not until a close examination has been made, that the presence of this pest is to be discovered.

In old trees the signs of attack are quite characteristic and consist in deep, irregular, longitudinal scars or furrows running up the trunk of the palm in continuous lines.

These scars are often from 3 to 4 feet in length and may be seen to occur on all sides of the trunk.

* Herbert Druce in Biol. Cent.—Amer., Heter., Vol. I., p. 24. 1881

The larvæ themselves live in the burrowings which they make between the trunk of the tree and the broad and thickened bases of the branches.

As development proceeds the burrowing is continued upwards till the base of the next branch is reached. The old branch eventually drops off and exposes the wound caused by the previous burrowing and in this way the described scars or furrows are formed.

In cases of severe attack the trunk of the palm immediately beneath the crown may become so weakened that a strong gust of wind causes the head to snap off. Frequent cases of this are to be observed on the West Bank of the Demerara River.

The financial loss involved by the retardation of growth and the not infrequent loss of a valuable palm by the persistent attacks of this pest is an exceedingly serious matter, especially as the adult insect is winged and capable of powerful and sustained flight.

DESCRIPTIONS OF VARIOUS STAGES OF LIFE HISTORY.

The egg has not yet been observed but it is probable that its appearance and the method of its deposition by the female moth are not unlike those of *Castnia licus*, the so-called giant moth-borer of sugar cane.

The larva or caterpillar is of a most formidable size, the largest specimen yet obtained slightly exceeding 4 inches in length when normally extended, and just short of one inch in breadth.

In colour it is either yellowish white or flesh-coloured; in shape it is distinctly elongate with the skin smooth. The head is small in comparison with the rest of the body and somewhat pointed, in colour it is dark brown, the mandibles and other mouth parts being almost black. The mandibles are powerful and well developed. A few coarse hairs of medium length and of a brown colour adorn the head and similar ones occur about the spiracles and anal segments.

The four pairs of abdominal feet are provided with two transverse rows of small but stout hooked spines.

Similar spines occur in a patch on the dorsum or back of each segment with the exception of the first thoracic segment

and the three last segments. The spiracles are prominent especially the prothoracic pair.

PUPA OR CHRYSALIS.

The largest one yet obtained measures three inches in length and $\frac{3}{4}$ of an inch at its broadest part. The more normal size is $2\frac{3}{4}$ inches in length and just over $\frac{1}{2}$ inch in breadth.

It is stoutish in shape, dark chestnut brown in colour with surface smooth and shining.

On the dorsum or back of each abdominal segment, extending laterally just beyond the spiracles there are two transverse rows of strongly reflexed spines. The uppermost row of spines on each segment are considerably more developed than the lower row. This lower row of spines is practically obsolete on the last two segments.

The head of the pupa is somewhat pointed.

ADULT MOTH.

The wing expanse varies from $6\frac{3}{4}$ to 6 inches, the difference in size being due to sex ; the female is the larger.

The general wing colour is a dark brown with light yellow markings.

The forewings bear two narrow diagonal bands of light yellow, the one nearer the apex of the wing being curved.

The hind wings bear two rows of marginal yellow spots. The antennæ are long, club-shaped, with the tips distinctly hooked. The underside of the body is lighter in colour with the same markings as the upper surface but not so clearly marked.

A metallic opalesence may be observed on those parts of the wings nearer the body.

LIFE-HISTORY AND HABITS.

At present but little is known with regard to the various metamorphoses connected with the life-history of this insect, and its method of living necessarily renders any close investigation an exceedingly difficult matter.

The larval and pupal stages extend in all probability over some months. Several larvæ have been induced to pupate

under laboratory conditions but none have yet emerged as an imago.

As previously stated the larva eats out galleries between the stem of the palm and the closely adhering bases of the branches. When ready to pupate a large, roughly formed, elongate cocoon is constructed of fibres.

Pupation takes place close to the exit of a gallery to the outside air, and previous to the emergence of the adult moth the pupa works its way partly out of this exit hole.

The moths themselves are entirely nocturnal in their habits, they may at times be seen on the wing at dusk.

METHODS OF CONTROL.

When once a palm has been allowed to become heavily infested, drastic measures are necessary to prevent further damage. All the lower branches have to be carefully removed by cutting them away at the base and eventually securing the worm.

Thus as many as 19 specimens of *Castnia daedalus* in its several stages of development have been taken from a single palm.

Palms in an infected district should be examined at regular intervals for the presence of this pest, and to this end the lower and older branches should be regularly removed and the tree kept generally clean.

It is only ignorant neglect that has allowed this pest to gradually become so serious a menace to the coconut cultivations of British Guiana.

No natural enemies have been discovered up to the present, but it was observed that palms inhabited by the so-called 'kop-kop' ants were as a rule uninfested by *Castnia daedalus*.

A Note on the Occurrence of *Fomes Semitostus* in British Guiana.

By C. K. Bancroft, M.A. (Cantab.), F.L.S., Government Botanist.

DURING a recent visit to the interior of the Colony the writer observed fructifications, or 'brackets' as they are popularly termed, of *Fomes semitostus* on a stump of a dead tree (species not known) on a trail leading from Tumatumari to Konawaruk. The brackets were identical with those which occur in the East, possessing dark and light brown zones on the upper surface, a yellow margin or lip and a bright orange coloured under surface.

This fungus, which is the cause of the common root disease of cultivated Para Rubber, is a parasite of considerable economic importance. Its occurrence in the Western Tropics has not to the writer's knowledge been recorded before, and would indicate a much wider distribution of the fungus than has previously been thought to occur.

Its occurrence in South America is of more than individual interest in that it adds another to the list of parasitic fungi of economic importance which are freely distributed in the tropics. Some of these fungi are *Phytophthora Faberi* the cause of the pod disease and canker of cacao, *Thyridaria tarda*, the die-back of *Hevea* and *Cacao*, *Marasmius Sacchari*, the root fungus of sugar-cane, *Hymenochaete noxia*, the cause of a root disease of *Hevea* and *Cacao*. These rank amongst the most important parasites which the cultivator has to deal with in the tropics at the present day. And as the work on plant diseases in the tropics progresses it is possible that a far wider distribution of parasitic fungi will be shown to occur than is indicated at present. To what extent they may have been introduced from one county to another or to how far they can really be regarded as native to the countries in which they now occur it is not possible to determine; but the fact that several of the most important fungi which are parasitic on cultivated plants in the tropics appear to possess such a wide geographical distribution is worthy of mention in view of the quarantine regulations now being enforced by many tropical countries.

Other 'bracket fungi' commonly seen in the East on dead wood, which were recorded during this visit, were ***Polystictus sanguineus*** and *Schizophyllum commune*.

Agricultural Instructors' Reports.

Pomeroon.

Agricultural Assistant Matthews reports from the Pomeroon that the cultivation of Coconuts is now generally being undertaken by the farmers and in the majority of cases satisfactory growth and freedom from disease was observed. Drainage appears to be the underlying cause of unsuccessful planting.

Coffee continues to do well though Scale Insects give trouble in some quarters; spraying with Rosin Wash was suggested as a remedial measure. Rubber where planted has done well, some of the trees having attained a tappable size; extension of the cultivation has in all cases been advised. Cacao is not thriving in all localities. Ground provisions and rice are up to the usual standard.

North West District.

Agricultural Instructor Abraham reports from Issorora Experiment Station, N.W.D., that agriculture in the Waini River district is in a deplorable condition which he ascribes to a lack of proper labour and the remote situation. Co-operative cultivation between the farmers was advised together with a more hopeful view of the situation, as the soil is undoubtedly fertile and will amply repay the proper cultivation of cacao, coffee and coconuts.

A corn disease has made its appearance among the farms situated on the Lower Aruka and Upper and Lower Barima Rivers resulting in considerable dimunition in yields.

The previous good drainage conditions in this District are being maintained.

The cultivation of white Tannia has been taken up in this area and as previously demonstrated at the Experiment Station is superior to the ordinary yellow variety.

Ground provisions are doing well.

Berbice.

Mr. Instructor Augustus reports that the principal farmers on the West and Corentyne Coasts of Berbice are paying more

attention to the preparation of their lands for rice. Iron ploughs have become quite numerous and are being used with marked success, which is a striking comparison with conditions some years ago.

Lectures were given at night to these farmers and seed paddy was also distributed.

Progress has also been made with the drainage on the farms situated on the Corentyne River. The dams have been strengthened and extended thus providing ample protection from the spring tides which have caused damage on previous occasions. Almost in every instance an extension of the cultivation was observed in this area.

Lectures and instruction were given to the teachers and children of a number of schools.

Chemotropism in Insects.

By the term "chemotropism" is meant, as it is well known the automatic orientation of the animals to any olfactory sensation in such manner that both sides of the body are struck by the lines of diffusion at the same angle. Theoretically, when a substance diffuses an odour, fine particles are ejected in straight lines, but in reality the air currents cause the lines to deviate from their straight tract, and for that reason we cannot expect insects in the case of chemotropic movements to follow such straight lines as in the case of photographic movements.

Chemotropism is a very important factor in the life of insects, and its positive action is especially evident in the following circumstances: in the search of the sexes for each other; in their search for food; and in ovipostion. On the other hand, the occurrence of negative chemotropism is demonstrated by the fact that many insects protect themselves against their enemies by discharging evil-smelling fluids, and so forth.

—"Bulletin of Entomological Research."

Hints, Scientific and Practical.

Causes and Treatment of Gummosis.

LEMON GUMMOSIS in at least two forms has been found to be readily transmissible from diseased to healthy trees by inoculation.

By series of many inoculations into healthy trees it has been found that the grey fungus (*Botrytis vulgaris*) is capable of inducing one form of gummosis, and that the brown rot fungus (*Pythia cystis citrophthora*) is capable of inducing the other.

Both these fungi have been isolated from trees affected with gummosis, and after inducing gummosis in healthy trees have been re-isolated from these inoculated trees. These fungi were found to be at the advancing margins of diseased areas in the bark and wood, and were not found in the exuded gum nor in the tissue already thoroughly permeated with gum.

The grey fungus (*Botrytis*) gummosis is characterized by a killing of the outer layer of bark much in advance of the inner, and by a softening of the bark and production of spores in moist weather, where the bark is entirely killed to the wood.

The brown rot (*Pythiacystis*) gummosis is characterized by a killing of the bark to the wood as the area of infection advances. without outward evidence of fungus at any time, the bark remaining hard during all stages of disease.

The concentrated Bordeaux paste is about the proportion of 1 pound of bluestone, 2 pounds unslaked lime to about 1½ gallons of water has given promising results in the treatment of these two forms of gummosis, providing the diseased areas were properly prepared before its application.

—"The Monthly Bulletin of the State Commission of Horticulture."—August, 1913.

Poultry Diseases.

INDIGESTION, Yaws and Roup are the most common troubles in chickens. It is not possible to rear chickens satisfactorily running among old hens. The chickens pick up large grain, and get pecks on the back of the head, which if vicious or

repeated often, makes them double up, look sickly and die. Picking up large grains, like corn or oats gives the chickens indigestion. There should be separate coops where the chickens can be fed. These save their cost many times over. When the crop of a chicken is stuffed up and the food won't move try first a half teaspoonful of water and a small pinch of bi-carbonate of soda, an hour later try a half-teaspoonful of sweet or salad oil, and knead the crop gently after both doses. This generally will move the contents of the crop but if not after a day or night, repeat another dose of both.

In extreme cases and when one can do simple surgery, and if the chickens is of particular value take a fine pair of scissors, clip off the feathers or down on the top of the crop, cut open the fine skin underneath, turn the bird over and gently squeeze out the contents of the crop, or take a small spoon and scoop the contents out; put in a little water coloured pink with Permanganate of potash, let this run out, and then sew up the outer skin of the crop with fine thread, oil the stitching and put the chicken by itself. Feed only a little soft food for two days and then the bird run.

A scour of Epsom Salts once a week will ward of indigestion in the stomach or bowels.

Tonic or Condition Powders, the best of which contain Charcoal, Iron, Epsom Salts, Sulphur, etc., are sometimes of good use.

Yaws are well known. We have described the cause and treatment over and over. Give Epsom Salts in the drinking water, paint the eruptions with Tincture of Iodine twice a day for two days, then anoint with the Lard, Sulphur and Kerosine ointment.

Roup is the worst trouble to handle when it gets through a flock and becomes virulent through not having been noticed in time. A few chickens can be treated easily, but when this trouble gets in a large flock, it is a very troublesome job to get the birds better. We shall treat this at the request of several correspondents and inquirers next month.

—"The Journal of the Jamaica Agricultural Society,"
July 1913.

Tuberculosis in Farm Stock and its Prevention.

VARIOUS schemes have from time to time been put forward having in view the eradication of the disease; most of them involve the periodical use of the Tuberculin Test, followed by the isolation, segregation, or even destruction of re-acting animals. These plans are open to criticism from the economic point of view, and no doubt if adopted generally would involve a huge expenditure, but it is beyond dispute that the disease has been eradicated from many herds by employing these methods, and sometimes with comparatively small expense.

It has to be borne in mind that the chief factor in the spread of the disease amongst cattle, and also from cattle to man, is the existence of animals in an advance stage of the disease, and particularly of cows with tuberculous udders. These sources of infection can be removed on detection, and their removal involves no more than the destruction of animals which are already either unprofitable or would soon become so.

It should further be pointed out that the more animals are kept indoors and crowded together in insanitary surroundings, the more likely is the disease to flourish, as, given the presence of the tuberculous animal, these conditions favour the spread of the disease to other animals in contact. It must not be thought, however, that the disease can be eradicated from an infected herd by providing a generous allowance of air space, and freely ventilating the buildings, for tuberculosis has been known to spread alarmingly in excellent cowsheds, and even cattle at pasture run serious risk of infection, if they are in association with other badly infected cattle. These remarks are not intended to belittle the importance of allowing a reasonable amount of air space per animal in the cowsheds, but to accentuate the importance of ridding a herd of the infective animals. After what has been said above it is unnecessary to enlarge upon the danger of allowing calves to suck a cow with a suspicious udder or one which is in the advance stages of tuberculosis. The milk of such cows should not be used to nourish animals or human beings. With regard to the by-products from creameries, separated milk for example, which is employed in some districts as food for pigs, the great risk connected with its use has already been referred to. It owes its dangerous quality mainly to the fact that it is the product of a very large number of cows, and the more cows contributing to the milk supply the greater will be the number supplying the

tuberculous milk. Creamery products, however, can be rendered harmless by exposing them to a temperature of 85C. (185F.) for fifteen minutes or bringing them to the boiling point.

Common feeding or drinking troughs should not be used, especially in infected herds.

Since tuberculous animals excrete virulent material into the cowsheds mainly from the lungs and the bowels, and since they cannot be expected to make use of spittoons and other sanitary appliances of civilisation, the need for frequent cleaning and disinfection of cowsheds, particularly the parts most liable to be contaminated by the fæces and the mucus from the lungs, is all the more pressing. In the liquid state these virulent materials may cause infection of the food or water by direct contamination, but it must not be forgotten that, if left to dry into dust may permeate the air of the cowshed, and be inhaled by other animals in more distant contact, or even contaminate their food.

—"The Journal of the Board of Agriculture of England."

Rat Extermination.

As a result of repeated trials and experiments of the destruction of rats, I find the most effective poison—in fact the only effective poison for the purpose—is strychnine, and the food chosen to mix it with should be that which the rats have hitherto been living on. For instance, where patches of bananas, or even only odd banana plants exist, it will invariably be found that the rats in the vicinity will readily eat bananas poisoned with strychnine, and they will under similar conditions take baits made out of sweet potatoes or of cane.

It is practically useless to poison rats (especially with cane baits) when they are revelling in acres of sweet cane. The time to poison with advantage is immediately after each cane-field is cut and burnt off, when poisoned cane will be found most effective. A farmer can always have a stalk or two of cane elsewhere for the purpose, or reserve a stool of his own cane. In the case of a crop of young plant cane, a few baits should be distributed as a precaution before actual signs of the pest are seen. Generally speaking, the period for poisoning is from Christmas to say April or May.

The utmost vigilance is necessary to detect the first signs of destruction, which when observed, should without loss of time be met by a plentiful distribution of baits.

I have found the most effective way of applying the strychnine as follows :—This poison as sold is too large in the grain, and should be ground as fine as possible. For this purpose an earthenware jar and a round headed bolt will be found suitable. After grinding, place the poison in a small tin, the lid of which should be perforated with very small holes, all of which must be made within a circle of about the size of a shilling. This will prevent the powdered strychnine from spreading too much when shaken out. The bananas used for poisoning should be neither too ripe nor too green, and in a similar condition to those used for ordinary consumption. If the banana is of medium size, cut it in two ; if large, cut it into three sections. Then cut each section lengthways, without cutting the back skin ; lay a number of the split sections, with their backs on, say, a newspaper, and shake the strychnine tin over each one. Then close the sections carefully together, and place them in a billy-can, ready for distribution.

I generally make up from 50 to 100 of these baits at a time.

In the case of cane being used for baits, take a piece of cane 4 or 5 inches in length, split it down lengthways into either two or three sections, according to its size, and pepper the strychnine over the inside of each section, then close and press the sections into their original positions, and so place them carefully in the can ready for putting out in the canefield.

Sweet potatoes can be used for baits in much the same way. The composition of either the banana, sweet potato, or sugar-cane is such as will readily absorb the strychnine, and this will be assisted by pressing the sections together as advised. It is absolutely essential, before preparing the baits, that a drop of essence of aniseed should be put on the hands of the person making up the baits, and another drop should be again used similarly just before distributing them. The aniseed not only does away with the smell of the hand from the bait, but has a strongly attractive smell for the rats.

When the cane baits are placed out in the field, the sections should be separated, and each one laid on its back, so that the rats can more easily gnaw them.

If the pest is to be properly stamped out, concerted action on the part of the owners of rat-infected farms is very necessary. It is certainly not encouraging for any one farmer to poison rats on his farm if his neighbours continue to breed him a fresh supply.

No cane-grower can object on the score of expense to poisoning on the lines here laid down. All that is required is an ounce bottle of strychnine, costing say 5s., and one of aniseed, 1s. Both should last quite a whole season, even on a badly infested farm. The food forming the baits costs really nothing, and can be made always available. There is also the time taken in preparing and distributing the baits, which would amount to about two hours, say twice a week for a few weeks of the year—a cheap process surely, and one which, if carried out systematically by each grower, will, I feel confident, speedily lead to the extermination of the pest.

I will shortly recapitulate the chief essential measures to be adopted for the destruction of the rat pest by strychnine poison :—

Use for poisoning the food the rats are used to.

Poison at the time of the year when the cane is not ripe.

Concerted action on the part of the growers is necessary to eradicate the pest, and the poisoning operations should be carried out systematically and intelligently.

Never forget to use the aniseed.

Keep clean all headlands. This will make the baits placed there more observable and more accessible to the rats.

—"The Australian Sugar Journal."

The Model Gardens.

Record of Attendances.

Below is given a table, arranged in quarterly periods setting out the number of pupils who attended the Model Gardens of the colony from April 1, 1907. These quarters (recorded below as 1st, 2nd, 3rd and 4th) run from January 1 to December 31. The totals only during 1907, 1908 and 1909 are given; the records since then are in detail.

Quarters.	Bourda.	Charlestown.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	La Grange, W. Bank. Dem.	Suddie, Essequibo.	Den Amstel.	Houston, E. B.	Wakenaam.	Total Attendances.
1907.										
2nd–4th	1,261	928	994	835	556	...	...	...	...	4,574
1908.										
1st–4th	5,447	3,386	1,477	887	1.053	160	...	...	...	12,410
1909.										
1st–4th	6,473	2,665	1,738	1,277	1,192	1,897	662‖	...	...	16,904
1910.										
First	1,282	769	287	370	259	489	465	..	...	3,921
Second	1,311	558	787	894	303	455	519	403§	...	5,240
Third	¶ 1,234	526	910	748	294	510	498	537	...	5,257
Fourth	1,209	444	1,285	336	295	493	502	592	...	5,156
1911.										
First	1,086	360	1,042	838	312	514	414	572	577	5,695
Second	1,263	326	713	816	286	292	536	591	688	5,511
Third	¶ 1,093	385	910	627	361	297	543	441	639	5,296
Fourth	1,687	448	935	588	447	406	737	957	540	6,745
1912.										
First	1,127	379	1,374	1,034	425	207	573	359	423	5,901
Second	1,385	359	1,096	900	484	553	730	461	413	6,381
Third	1,416	400	763	889	412	572	621	616	443	6,132
Fourth	1,586	254	1,162	479	459	768	620	720	439	6,487
1913.										
First	1,613	464	1,060	637	529	764	661	464	342	6,534
Second	1,273	498	1,368	863	517	766	653	508	401	6,847
Third	1,176	495	904	670	498	945	736	475	333	6,232

Note.—The figures for the Country Model Gardens quoted above refer only to the numbers present during instruction given by the Superintendent Teacher. It has not yet been found feasible to keep reliable, full records of the very numerous attendances during his absence

¶ Schools in vacation during August.

‖ Instruction commenced in July.

§ Instruction commenced in April.

Exports of Agricultural and Forest Products.

Below will be found a list of Agricultural and Forest products of the colony exported this year up to Oct. 13th, 1913. The corresponding figures for the three previous years are added for convenience of comparison :—

Product.	1910.	1911.	1912.	1913.
Sugar, tons ...	46,920	52,835	32,736	60,019
Rum, gallons ...	1,626,480	1,542,067	1,504,467	3,109,169
Molasses, casks ...	631	879	906	76,202
Cattle-food, tons ...	4,751	3,287	3,111	10,003
Cacao, cwts. ...	443	798	102	373
Citrate of Lime, cwts.	76	56	5	6
Coconuts, thousands	681	682	943	988
Copra, cwts. ...	210	1,038	963	1,365
Coffee, cwts. ...	978	925	1,225	1,374
Fruit, brls. and crates	...	...	...	...
Ground Provisions, value	$546 12	...	...	...
Kola-nuts, cwts. ...	9	...	...	1
Rice, tons ...	4,141	1,883	2,365	9,016
Rice-meal, tons ...	1,555	974	1,484	2,738
Starch, cwts. ...	4	...	..	...
Cattle, head ...	1,049	832	434	969
Hides, No. ...	4,574	3,152	3,025	6,447
Pigs, No. ...	872	1,013	997	2,156
Poultry, value... ...	$ 67 98	...	...	..
Sheep, head ...	122	40	61	40
Balata, cwts. ...	6,570	5,712	2,287	8,168
Charcoal, bags ...	71,222	55,956	52,099	72,455
Firewood, Wallaba, etc., tons ...	7,509	8,130	7,320	10,910
Gums, lbs. ...	1,507	3,246	3,041	3,030
Lumber, feet ...	202,027	310,131	155,423	714,742
Railway Sleepers, No.	5,700	3,920	4,046	8,221
Rubber, cwts. ...	12	23	2	12
Shingles, thousands	1,802	2,035	1,667	3,289
Timber, cubic feet	222,681	161,556	244,940	614,612

Selected Contents of Periodicals.

Digestibility experiments with sheep. Para Rubber Seed Cake.
The distribution of atmospheric impurities in the neighbourhood of an industrial city.
The movements of soil water in an Egyptian Cotton Field.
—"The Journal of Agricultural Science," October, 1913.

On the Economic value of wild birds.
—"The Agricultural Journal of the Union of South Africa," September, 1913.

Quarantine Systems.
—"The Colonial Journal," October, 1913.

Tapping experiments on Hevea.
The cost of making copra.
Spices.
—"The Tropical Agriculturist," September, 1913.

The manuring of paddy.
—"Agricultural Bulletin of Federated Malay States," July, 1913.

Tuberculosis in Farm Stock,
—"The Journal of the Board of Agriculture of England," September, 1913.

Experiments in the application of electricity to Crop Production.
The Tenth International Congress of Agriculture.
Sugar Beet in the United States.
—"The Journal of the Board of Agriculture of England," October, 1913.

Some problems of Rice improvement in Burma.
—"The Agricultural Journal of India," October, 1913.

The Gasolene Torch Treatment of Date Palm Scales.
—"Journal of Economic Entomology," October, 1913.

The Insect Fauna of the Soil.
—"The Journal of Economic Biology," September, 1913.

JOURNAL

OF THE

BOARD OF AGRICULTURE

OF

BRITISH GUIANA.

VOL. VII. JANUARY, 1913. No. 3.

A Plea.

"THE man who reads is the man who succeeds" is perhaps a somewhat time-worn adage but nevertheless it is still applicable to those who earn a livelihood by the tilling of the soil in British Guiana.

Improvements, fresh ideas or additions to the various branches of Agriculture, the outcome of scientific research or practical experience that may be evolved in other parts of the world must necessarily become known to us in this colony in the form of literature, and it naturally follows that the man who devotes some part of his time, however small, to the intelligent perusal of such literature and agricultural literature generally stands a far better opportunity of succeeding than the man who elects to do without it and consequently continues in his unprofitable and out-of-date methods.

We would therefore very earnestly recommend the regular perusal of this Journal to the agriculturist of the colony for in whatever form of agriculture he is engaged he cannot but find among these pages valuable hints and advice in a readable and understandable form.

Meeting of the Board of Agriculture.

A meeting of the Board of Agriculture was held on the 11th December, 1913, His Excellency the Governor presiding, with Professor J. B. Harrison, chairman, Mr. C. K. Bancroft (deputy chairman), the Hon. Dr. J. E. Godfrey (Surgeon General), the Hon. E. C. Buck (Colonial Civil Engineer), the Hon. F. Dias (Mayor of Georgetown) and Messrs. F. Fowler, O. Weber, G. E. Bodkin, A. Seton Milne, T. Earle, J. Gillespie, B. Gainfort and E. S. Christiani (Secretary) in attendance.

Mr. R. Ward and Dr. E. P. Minett were also present.

His Excellency spoke first of the recent outbreak of Mal de Caderas, the nature of which had unfortunately been misunderstood but was now known to be infectious. The present restrictions concerning the movements of animals in connection with this disease were not sufficiently stringent and it was proposed that stricter regulations should be made by the full Board and not by a Committee of the Board.

Professor Harrison then read the amended order which was unanimously approved of by all the members of the Board present.

His Excellency then mentioned that it was proposed to appoint Captain Farrant Veterinary Surgeon to superintend veterinary matters in Berbice and that he should be assisted wherever possible by the police and road officers. The meeting then terminated.

Distribution of Stable Flies.

The stable fly (*Stomoxys calcitrans*) is one of the most widely distributed insects, rivalling the house-fly in this respect. It occurs commonly in parts of every zoological region and practically throughout most of them. It is probably native to the palæarctic region from whence it has followed man in his migrations to all parts of the world. In the United States it was common in the vicinity of Philadelphia as early as 1776 It is not equally abundant everywhere that it occurs but is so much more common in temperate regions such as the United States and Argentina. In the tropics it occurs very generally, but almost in lesser numbers than in cooler climates.

—"The Journal of Economic Entomology," December, 1913.

Retirement of Mr. J. F. Waby.

On the 31st of December, 1913, Mr. J. F. Waby retired from the post of Head Gardener which he had held for the past 35 years.

Mr. Waby's name is familiar to all readers of the Journal as on numerous occasions he has contributed articles on a number of subjects and his book 'Tropical Gardening' has long been a standard work on this subject both in this colony and the West Indies generally. His knowledge of the Flora of British Guiana is unique and happily this knowledge will still be available as His Excellency the Governor has appointed him a member of the Board of Agriculture in recognition of his services.

His absence will be severely felt for he was universally appreciated both as an earnest fellow-worker and a personal friend. On his retirement the members of the Department of Science and Agriculture subscribed towards a presentation as a token of their appreciation and esteem.

We wish Mr. and Mrs. Waby all health and happiness in the years to come.

Fowl Houses.

Mr. Cecil L. Byrne, late lecturer at the Royal Agricultural College, Sheffield, says :—" It may be well to give a definite rule for ascertaining how many birds a given house will contain healthy.

" The best way to find out how many fowls a house will hold is to multiply its length by its breadth, and its mean height, and divide by eight. This will give you the maximum number of birds. If not pressed for room, divide by ten. Here is an example: Take a house 6 ft. high, 6 ft. long, and 4 ft. wide—i.e., 6 by 6 by 4= $144 \div 8 = 18$. Thus such a house will hold eighteen birds."

—Queensland Agricultural Journal, December, 1913.

The Scale Insects of British Guiana.

A preliminary list with an account of their host plants, natural enemies, and controlling agencies.

By G. E. Bodkin, B.A., Dip. Agric. (Cantab), F.Z.S., F.E.S., Government Economic Biologist.

INTRODUCTORY.

An examination of the literature concerning the Coccidae or Scale Insects reveals but few references regarding the study of those species occurring in British Guiana* and the majority of these are to be found in the Entomologists Monthly Magazine between the years 1888–1894. Scattered references, mostly derivated from the above articles, as to the occurrence of a number of species in this country appear in the Bulletin of the Botanical Department of Jamaica, the journal of the Institute of Jamaica, Scale insects of the lesser Antilles, (a Bulletin of the Imperial Department of Agriculture for the West Indies), The West Indian Bulletin, and Mrs. Fernald's "Catalogue of the Coccidae of the World."

The following is a short historical account of previous work on the Coccidae of British Guiana :—

To the best of our knowledge this work may be said to have commenced in 1888 when a number of commonly occurring species were collected in the Botanic Gardens, Georgetown, by Robert Ward (the present Agricultural Superintendent) and forwarded in accordance to a previously arranged plan to Mr. S. J. McIntire of Shepherds Bush, London, who at that time was making a study of these insects. These specimens were examined both by him and Mr. J. W. Douglas, F.E.S., and the results of their studies were published in the Entomologists Monthly Magazine, the Journal of the Quekett

* In many catalogues both Demerara and British Guiana are given as the habitat for a scale insect. In passing it should be noted that Demerara is one of the counties of British Guiana, the others being Berbice and Essequibo, and consequently when dealing with any Coccid from this country it is adequate to write 'British Guiana' as a habitat.

Microscopical Club and in two other articles both appearing in "Timehri," the Journal of the Royal Agricultural and Commercial Society of British Guiana, the one ** written and illustrated by Mr. S. J. McIntire and the other † more from the economic point of view by R. Ward.

The original drawings of the plates by the author accompanying Mr. McIntire's article as well as a number of his original mounted microscopical specimens are preserved in this laboratory.

Between the years 1888–1894 a number of articles dealing with Demerara Coccidae appeared in the Entomologists Monthly Magazine written either by Mr. J. W. Douglas, F.E.S., Mr. A. C. F. Morgan. F.E.S., Professor R. Newstead, and Mr. E. E. Green, F.E.S., and the specimens concerned were collected in the Botanic Gardens, Georgetown, by Mr. G. S. Jenman, F.L.S. In this way some 22 distinct species of scale insects were described either for the first time or identified from previously described species. During recent years with the exception of a small collection made by Mr. A. W. Bartlett who for some years was Government Botanist, no further work to our knowledge has been done on the Coccidae of this tropical part of South America.

The collection on which the present article is based has been formed almost exclusively by the author since his first arrival in the colony in June, 1911. Practically every part of the cultivated areas of the colony have since that time been visited and a number of trips made into the uncultivated forest areas, thus excellent opportunities have occurred for the collection of these insects which after all is not a difficult matter for those possessed in some measure of the power of observation and a knowledge of the likely habitats of scale insects.

A fairly representative collection of the Coccid fauna of this part of the world has resulted.

There are a number of species not mentioned in this article which are at present under examination and doubtless there still remain a number of undiscovered species ; in course

** Timehri, Vol. 3, New Series, 1889, p. 313.

† Timehri, Vol. 4, New Series, 1890, p. 302.

of time as these are brought to light it is proposed to publish a further and completer list.

Owing to the large number of species already identified and to the advisability of publishing these records at an early date, this preliminary list has been issued.

The majority of the determinations were made through the Imperial Bureau of Entomology by Professor Robert Newstead, of the Liverpool School of Tropical Medicine, the well known authority on the Coccidae. A few of the identifications of the commoner species were made in this laboratory.

With the exception of certain species* either dried or microscopical preparations and in many cases both of the species enumerated in this article are preserved in this laboratory.

For the sake of convenience the classification adhered to throughout is that adopted by Mrs. Fernald in herwell known catalogue.†

ECONOMIC IMPORTANCE, DISTRIBUTION, AND CONTROLLING AGENCIES.

Scale insects, popularly and collectively known in Demerara as 'blight,' although somewhat inconspicuous are of far greater economic importance than is generally supposed and in British Guiana they may be considered as one of the worst type of pests withwhich the cultivator has to contend.

Some half dozen species widely distributed throughout the cultivated areas of the colony, and capable of existing on a variety of cultivated plants, are annually responsible either directly or indirectly for an enormous amount of damage. Such species as Aspidiotus destructor. Signoret, Lepidosaphales beckii, Newm. Ischnaspis longirostris. Sign, Pseudococcus citri. Risso, Saissetia nigra. Neitn, are pre-eminent in this respect.

* Diaspis echinocacti opuntiae. Ckll, Aspidiotus diffinis. Newstead, Saissetia begoniae. Dougl. Lecaniodiaspis dendrobii. Dougl. Lepidosaphes pinnaeformis. Bouché, Chrysomphalus dictyospermi areeae. Newt. Chrysomphalus dictyospermi. pinnulifera, Mask. Chrysomphalus dictyos permi. Morgan. Morganella longispina. Morgan, Tachardia lacca. Kerr and Ceroplastes denudatus. Ckll.

† A Catalogue of the Coccidae of the World. Mrs. Maria E. Fernald. Amherst, Mass. U.S.A. 1903.

A large number of species are most commonly found on plants and shrubs grown for ornamental purposes in sheltered situations. Thus a collection of orchids or ferns grown in a carefully sheltered enclosure unless constantly attended are particularly liable to become infected with a number of different species of Coccids.

Some trees and plants appear to be perpetually infested with certain species of scale insects, for instance a mango tree whose leaves and fruits are free from the Mango Snow Scale. (*Aulacaspis rosae. Bouché*) is hardly ever seen and sugar-cane is invariably affected by the well-known sugar-cane Mealy Bug (*Ripersia* sp.).

A number of species are undoubtedly indigenous and at the same time a large number must from time to time been introduced from other countries and from the nearby West Indian Islands whence constant importations of provisions and fruit are being made.

A notable absence is the Japanese Fruit Scale (*Aulacaspis pentagona Targ*) which is so common in the West Indies generally. It has never to the best of our knowledge been collected in this colony. *Parlatoria ziziphus. Lucas.* which occurs on citrus fruits is, we believe, entirely new to the West Indies.

A number of species described by Newstead. Douglas and Morgan, have not been collected during recent years. these have been noted in the text.

A somewhat curious feature of the distribution of the Coccidae in this country is the occurrence of certain well known species on trees and orchids growing in the virgin forests of the interior. Thus the well-known *Aspidiotus destructor, Sign and Vinsonia stellifera. Westw.* have on several occasions observed to occur in such places. Another feature of the distribution of these insects is their invariable presence in the cultivations of the Aboriginal Indians which are far removed from one another and from the large cultivated coast areas ; this is an admirable illustration of the rôle played by human agency in the dissemination of such pests.

The quantities of honey dew secreted by a number of the Coccidae which infest cultivated plants often proves trouble-

some as it rapidly covers the exposed surface of the leaves and in course of time becomes covered with a sooty adhesive fungoid growth which effectively blocks up the stomata and thus seriously hinders the natural functions of the plant.

This is particularly the case with mango trees infested with the Mango Shield Scale (*Coccus mangiferae. Green.*) and other plants infested with *Orthezia insignis. Douglas.*

Ants are greatly attracted by this honey dew and will to their own ends carefully tend and protect a colony of Coccids. At one time it was surmised that the ants were actually destoying the scale insects but further investigation clearly demonstrated the truer relationship. Coccidae thus protected by ants from the attacks of internal parasites and parasitic fungi multiply more rapidly than when unattended.

Parasitism is necessarily one of the main features of insect life in the Tropics and the Coccidae are no exception. Practically every species suffers from the attacks of parasites belonging to the parasitic Hymenoptera.

Many of these have been reared from their hosts but owing to the difficulties of obtaining determinations they have not been dealt with in this article. It is projected to deal with them and other enemies in a later article.

Other natural enemies consist of Lepidopterous coccophagous larvae, entomogenous fungi, Coccinellid beetles in their larval imaginal and forms, and the larvae of lace wing flies (Neuroptera).

Three species of coccophagous Lepidopterous larvae occur in British Guiana and have recently been determined by Dr. Dyar of the United States National Museum. One species belong to the family Blastobasidae and is termed Blastobasis lecaniella. Busck, and the other two, both of which proved to be new species of Pyralids, Dr. Dyar proposes to term Vitula Bodkini and Vitula toboga* respectively. These three speciess of larvae are of fairly common occurrenc amongst the following Coccids: Saissetia nigra. Nietn, Saissetia oleæ. Bern, Saissetia hemisphaerica. Targ. and Ceroplastes floridensis Comstock. The larvae of these moths completely enclose the

* This species, Collected by H, W, B. Moore,

Coccidae which they are attacking with a silken web and the actual attack and partial life-history of Vitula bodkini, has been observed to take place asfollows :—

As a rule only the adult female scales are attacked and this fact very materially increases the utility of this natural enemy as the eggs which are contained beneath the scale till they hatch are consequently destroyed.

The larva first makes a hole in the side of the exterior hard covering of the scale and then introducing its head and thoracic segments, completely cleans out the contents of the shell.

The larva is dark brown in colour with the following characteristics :—The first thoracic segment is composed of a dark almost black, chitinous band and the 3rd thoracic segment and the first abdominal segment are also of a darkened colour the rest of the body being lighter in colour though darkened somewhat towards the anal extremity.

The thoracic segments are somewhat elongated and when the larva is feeding beneath a scale they are considerably drawn out giving the larva a maggot-like appearance.

The whole body is sparsely covered with short stiffish hairs each arising from a separate tubercle. The mandibles are prominent and the abdominal feet are but poorly developed. A full grown larva is 9 mm. in length and 3 mm. in breadth.

The pupa is contained in a white silken cocoon, it is light chestnut brown in colour, 5.5 mm. in length and 1.4 mm. in breadth. The pupal period is about 2 weeks under normal circumstances.

Of the Coccinellidæ two species which destroy Aspidiotus destructor. Sign. have recently been described * by G. A. K. Marshall as Cryptognatha nodiceps. Mshl, and Azya trinitatis. Mshl. Azya pontibrianti. Muls is predaceous on S hemisphaerica. Targ. There are a number of other species which await determination, likewise lace wing flies.

Two species of entomogenous fungi are frequently found attacking colonies of scale insects. These are the well-known

* Annals and magazine of Natural History. Sec. 8, Vol x, September, 1912.

red-headed fungus. (Sphaerostilbe coccophila. Tul.), and the shield scale fungus (Cephalosporium lecanii). The red-headed fungus principally attacks the Orange Snow Scale (Chionaspis citri. Comstock) while the Shield Scale fungus attacks Saissetia nigra. Nietn, Saissetia oleæ. Bern, Saissetia hemisphaerica. Targ. Coccus mangiferae. Green, and Coccus hesperidum, Linn. On the coast-lands where the rain is neither so equally distributed over the year or so heavy as in the interior districts these fungi do not flourish and a protracted spell of dry weather will render them inactive. Especially in citrus cultivations situated inland the common and injurious Coccid fauna of citrus trees is kept greatly in check by those parasitic fungi

ARTIFICIAL CONTROL MEASURES.

It has long been a recognised fact that plants which are showing a strong healthy growth due to their careful cultivation and management but seldom show a tendency to be infested by scale insects. Prevention is indeed better than cure and the cultivator should cosequently bear in mind that it is a considerably more profitable business to cultivate plants than to merely grow them.

A scale insect obtains its food by means of its long rostrum or proboscis which it thrusts into the plant tissues and the plant juices are thus absorbed. Consequently any scale-destructive liquid that is to be applied in the form of a spray must be so constituted as to kill the insects by external contact, as it is obviously impossible to cause death by means of a stomach poison.

There are in these days a vast number of different kinds of insecticides on the market devised to the above ends but local experience has shown us that there are two really efficient simple, cheap, and easily prepared washes within the reach of any cultivator by means of which he can control scale infestation. They are kerosene emulsion and Rosin compound.

A method of preparing kerosene emulsion for use against the softer bodied scale insects such as Aspidiotus destructor, mealy bug, croton bug, etc., and which has proved most convenient is as follows :—

Kerosene Oil	2 galls.
Water	1 gall.
Soap	½ lb.

The soap is first dissolved in the water which is heated for this purpose and the kerosene added while the solution is still hot.

The mixture is well stirred so as to form a good emulsion.

For use six gallons of water are added and the whole well mixed.

Rosin compound is an excellent wash for the hard-bodied scales though it may be used with good results against any kind of Coccid. It is prepared as follows :—

{ Rosin (powdered), 3 lbs.
{ Ordinary washing Soda, 2 lbs.

These substances are thoroughly mixed and dissolved by heat in a large vessel in about a gallon of water and water up to about four gallons is gradually added. Boiling is continued till the solution turns a clear brown colour.

Four parts of water to one part of this mixture are the correct proportions for use.

In the case of either of these washes several applications at intervals of a week should be given till the foliage, branches, etc., appear clean.

In applying these washes with a spraying machine care should be taken that the spray falls on the foliage in as a finely divided state as possible for in this condition it will adhere better and a completer covering will be obtained.

This effect is best produced by standing when spraying at some distance from the plants and keeping up a good pressure in the machine.

Spraying should preferably be done in the early morning or late afternoon in order to avoid the heat of the day.

In the following list short descriptions in simple language are given of all the commonly occuring Coccids and for the sake of convenience a list of cultivated plants with the scale insects that attack them is appended.

COCCIDAE.

Sub-Family DIASPINAE

GENUS CHIONASPIS SIGNORET.

1. *Chionaspis citri. Comstock.*—(The Orange Snow Scale). Occurs commonly on the trunks, branches, twigs of the different varieties of citrus plants, and also on the castor oil plant. It forms a white incrustation consisting of the male and female scales.

GENUS HOWARDIA. BERL. E. LEON.

2. *Howardia biclavis. Comstock.*—Occurs commonly on the branches of Jasmin. (Tabernemontana walichii). It is a rounded, convex scale closely resembling the colour and texture of the bark.

3. *Howardia biclavis detecta. Maskell.*—Occurs rarely on branches and twigs of the native rubber-producing tree (Sapium Jenmani). A large sized, rounded, whitish, easily discernible scale.

GENUS DIASPIS. COSTA.

4. *Diaspis boisduvalii. Signoret.*—Occurs frequently on the stems of plantains (Musa-paradisica) and the orchid Cattleya superba. The female scale is inconspicuous being flattened and coloured similarly to the plant. The males are white, rod-shaped conspicuous, and more numerous than the females around which they cluster.

5. *Diaspis echinocacti opuntiae. Ckll.*—This species recorded by T. D. A. Cockerell * on leaves of Opuntia elongata and also by Newstead.** It has not to our knowledge been recorded in British Guiana since that time.

GENUS AULACASPIS. CKLL.

6. *Aulacaspis rosae. Bouché.*—(The Mango Snow Scale). A common species on the leaves of mango trees (Mangifera indica) and cinnamon (Laurus Cinnamonum). The female scale is

* Jn. Inst., Jamaica. i. p. 256, 1893.

** Entomologists Monthly Magazine. Vol. xxv., 1889, p. 352.

white, flattened and pear-shaped. The male scales are also white, rod-shaped and more numerous than the female scales about which they cluster.

GENUS. HEMICHIONASPIS. CKLL.

7. *Hemichionaspis. minor. Mask.*—Fairly common on cotton plants. Closely resembles the Orange Snow Scale but is smaller.

GENUS PINNASPIS. BOUCHÉ.

8. *Pinnaspis buxi. Bouché.*—Common on a number of different species of ornamental palms. Also garden plants such as Monstera deliciosa and Anthurium magnificum. It is a small very brown flattened, pear-shaped scale. Occurs in large numbers on both sides of the leaves.

GENUS ASPIDIOTUS. BOUCHÉ.

9. *Aspidiotus cydoniae. Comstock.*—Occurs at times on the stems of the egg plant (Solanum melangeria.) A small yellowish white rounded scale, with a central brown spot consisting of the cast skins.

10. *Aspidiotus destructor. Signoret.*—Recorded in 1893 from Demerara by R. Newstead.

Perhaps the most commonly occuring and certainly the most injurious Coccid in British Guiana. Exceedingly injurious to the leaves of coconut palms, plantains (Musa paradisica) banana (Musa Sapientum), almond tree (Terminalia catappa), avocado (Persea gratissima), stephonotis (Stephonotis floribunda), and a large number of other cultivated plants.

It is a flattened, papery scale with a central yellow spot. It occurs massed together and overlapping in enormous numbers.

11. *Aspidiotus diffinis. Newstead.*—Recorded and described in 1893 by R. Newstead as a new species of Coccid from Demerara. The species has not been collected in British Guiana since that time but has been collected in Washington, D.C., U.S.A., by Marlatt * on lilac, during recent years.

12 *Aspidiotus sacchari. Ckll.*—(The Sugar Cane Aspidiotus). A fairly common species on sugar-cane. It is rounded

* Ent. News. Vol. xi. p. 425. 1900.

in shape and of a light yellowish colour, most frequently found on those parts of the stem and roots beneath the surface of the soil.

GENUS MORGANELLA. CKLL.

13. *Morganella longispina. Morgan.*—Recorded and described by A. C. F. Morgan * in 1889 as a new species from Demerara on Cupania sapida. A recent careful search of a large number of plants of this species has failed to disclose its presence.

GENUS SELENASPIDUS. CKLL.

14. *Selenaspidus articulatus. Morgan.*—(The West Indian red scale). Occurs commonly on all the varieties of citrus plants and on the leaves of Liberian coffee (Coffea liberica). Recorded and described by A. C. F. Morgan ** in 1889 as a new species of Coccid from Demerara, on the leaves of Dictyospermum album. A flattened,rounded, scale with brown central spot and margin yellowish. The exterior scale or covering is easily moved exposing the insect beneath.

GENUS CHRYSOMPHALUS. ASHM.

15. *Chrysomphalus aonidum. Linn.*—(The red-spotted scale). Occurs frequently on the leaves of all the varieties of citrus plants. An almost black, rounded scale, with a distinctly raised, red, central spot.

16. *Chrysomphalus aurantii. Mask.*—Occurs rarely on citrus plants. It is a flattened scale, reddish in colour, and the outline is indistinct. The exterior scale is transparent.

17. *Chrysomphalus biformis. Ckll.*—Occurs commonly on the leaves of most orchids especially Schomburghia crispa, also on young Sisal plants (Agave rigida var. Sisalana). A flat dark brown conspicuous scale rounded in shape. The male scale is oval, smaller, and of the same colour. The two sexes appear together, the males being the more numerous.

* Entomologists Monthly Magazine, Vol. xxv, 1889. p. 352.
** Entomologists Monthly Magazine, Vol. xxv, 1889. p. 352.

18. *Chrysomphalus dictyospermi. Morgan.*—Recorded and described by A. C. F. Morgan in 1889 † as a new species of Coccid from Demerara on Dictospernum album. This species has not been collected in British Guiana during recent years despite of continued search.

19. *Chrysomphalus dictyospermi pinnulifera. Mask.*—Recorded by Maskell ‡ as occurring in Demerara on Crotons (Codiaeum *spp.*). The species has not been recorded from British Guiana since that time.

20. *Chrysomphalus dictyospermi. arecæ. Newst.*—Recorded and described by Newstead ‖ in 1893 as a new species of Coccid from Demerara on Areca triandra. Continual search has failed to produce this species at the present time.

21. *Chrysomphalus personatus. Comstock.*—First recorded from British Guiana in 1888 by Morgan. Occurs commonly on the leaves of star-apple (Chrysophyllum Cinito), ornamental palms and mangoes. Occurs occasionally on the leaves of cultivated Para rubber trees (Hevea Brasiliensis). It is a relatively small, black, and distinctly convex scale easily recognised by its height and circular outline.

GENUS LEPIDOSAPHES. SHIMER.

22. *Lepidosaphes beckii. Newm.*—(The Orange Mussel scale) One of the commonest Coccids in British Guiana. Occurs on all parts of citrus plants, crotons, Barbados cherry (Malphigia glabra) and a large number of ornamental plants. It is a mussel-shaped scale, elongated and brown in colour. Often occurs in thickincrustations.

23. *Lepidosaphes pinnaeformis. Bouché.*—Recorded by Maskell ¶ from Demerara in 1892 on crotons. The species has not been discovered here during recent years.

GENUS ISCHNASPIS DOUGLAS.

24. *Ischnaspis longirostris. Sign.*—This species was recorded from Demerara by J. W. Douglas in 1888 on mango leaves.

† Entomologists Monthly Magazine, Vol. xxv, 1889. p. 352.
‡ Entomologists Monthly Magazine, Vol. xxviii, 1892.
‖ Entomologists Monthly Magazine, Vol. xxix, 1893. "Observations on Coccidæ," by R. Newstead, F.E.S.
¶ Entomologists Monthly Magazine, Vol., xxvii. 1892, p. 69 "Migrations and New Localities of some Coccids," by W. M. Maskell.

Frequently occurs on the leaves of Liberian Coffee (Coffea liberica) where it is a most pernicious pest. It also occurs on ornamental palms. Newstead records it on the leaves of Magnolia grandiflora from Demerara in 1892. From its long narrow rod-like shape, black colour, and habit of occurring on the ribs of the leaves it is easily recognized.

GENUS PARLATORIA. TARG.

25. *Parlatoria ziziphus. Lucas.*—Occurs occasionally on the leaves of citrus plants. The species is oval in shape, flattened and black in colour. Occurs almost exclusively on the leaves.

Sub-Family. ORTHEZINAE.

GENUS ORTHEZIA. BOSC.

26. *Orthezia insignis. Douglas.*—This species was recorded from Demerara in 1888 by McIntyre. It a common and exceedingly injurious species. It is found on many plants of the Natural Order Compositae and several species of citrus plants. The full-grown insect carries from its hinder extremities a long white egg sac, which curves upwards to a slight extent. Usually occurs in large numbers.

27. *Orthezia praelonga. Douglas.*—(The Croton Bug). A fairly common species. Recorded from Demerara by Douglas in 1890. Infests crotons, mango, Barbados cherry. (Malphigia glabra) sugar cane, the native rubber-producing tree (Sapium jenmani) and a number of ornamental plants. Almost identical in appearance to the previous species.

Sub-Family. DACTYLOPIINAE.

GENUS ASTEROLECANIUM. TARG.

28. Asterolecanium bambusae. Bdv. (The Bamboo scale). A common species on Bamboo. It is a small oval shaped scale, greenish yellow, with a fringe of distinctly pink filaments. Occurs in large numbers.

29. *Asterolecanium fimbriatum. Fonsc.*—Recorded from Demerara by Morgan in 1889 on leaves of Cupania sapida but not since collected.

30. *Asterolecanium pustulans. Ckll.*—(The Akee scale) A fairly common species on the leaves of orchids, and Akee (Blighia sapida). It has at times proved destructive to Para Rubber Trees (Hevea brasiliensis). In shape it is more rounded than the Bamboo scale and has the habit of existing in a hollow on a raised lump.

GENUS LECANIODIASPIS. TARG.

31. *Lecaniodiaspis dendrobii. Douglas.*—Recorded and described as a new species of Coccid from Demerara in 1892 by J. W. Douglas.* The species has not been collected during recent years. The food plants according to Douglas and Newstead are Dendrobium calceolaria and Croton.

GENUS. CEROPUTO. SULC.

32. *Ceroputo barberi. Ckll.*—Recorded by A. W. Bartlett on Schinus terebinthifolius. It is a flat insect covered with short, thick, spines of white wax.

GENUS PSEUDOCOCCUS. WESTW.

33. *Pseudococcus citri. Risso.*—(The common Mealy Bug). Is an exceedingly common pest on several varieties of citrus plants, cacao, several species of ferns, crotons, rice plants, several species of grasses, and rarely on sugar cane. The species is of medium size, pink in colour, and the margin bears a 'frill' of white waxy spines. The body is thinly covered with white wax.

34. *Pseudococcus nipae. Mask.*—Recorded from Demerara in 1893 by R. Newstead. Occurs occasionally on coconut and other ornamental palms. A small rounded insect covered with yellow wax which projects from the margin.

35. *Pseudococcus virgatus. Ckll.*—Occurs occasionally on the egg plant. (Solanum melangeria). A comparatively large species with long hairs and covered with grey wax.

GENUS RIPERSIA. SIGN.

36. Ripersia sp. (The Sugar Cane Mealy Bug). This sepecies has not yet definitely been determined by Professor

* E.M.M. Vol. XXVIII., p. 207., 1892. Notes on some British and exotic Coccidae, by J. W. Douglas.

Newstead. It is the commonly occurring sugar cane mealy bug. It is large in size, pink, and sparsely covered with wax. Found invariably beneath sheathing leaf-base of sugar cane.

Sub-Family TACHARDIINAE

GENUS. TACHARDIA. R. BLANCHARD.

37. *Tachardia Lacca. Kerr.* (The Lac producing insect of India). This species was collected in 1890 by Robert Ward on young plants of coca (Erythroxylon coca) in the Botanic Gardens, and recorded* by him in "Timehri" the Journal of the Royal Agricultural and Commercial Society of British Guiana. The species appears to have become extinct here during later years.

Sub-Family COCCINAE.

GENUS. PULVINARIA. TARG.

38. *Pulvinaria* sp. This species has not yet definitely been determined by Professor Newstead. It rarely occurs on the leaves of sugar cane.

39. *Pulvinaria pyriformis Ckll.*—(The Mealy Shield Scale.) Occurs fairly commonly on the leaves of guava (Psidium guajava), avocado (Persea gratissima) and several ornamental plants. When full grown it is brown in colour, and beneath the insect is a mass of cottony white wax containing the eggs. Flat and light green when young

40. *Pulvinaria Simulans. Ckll.*—Recorded by A. W. Bartlett on Licnata grandis.

GENUS CEROPLASTES. GRAY.

41. *Ceroplastes denudatus Ckll.*—Recorded by Cockerell in 1893 as occurring on croton. This species has not been collected here of recent years.

42. *Ceroplastes dugesii. Towns.*—Recorded by A. W. Bartlett on Schinus terebinthifolius.

43. *Ceroplastes floridensis. Comst* –(The Florida Wax Scale). A common species on lime plants and several species of ferns.

* Timehri. Vol. iii. New Series, 1890. p. 302. "Notes on Scale and other Parasitical Insects" by R. Ward.

A small insect by comparison with other Ceroplastes. The covering of wax is not arranged in plates and is pink in colour.

GENUS VINSONIA. SIGN.

44. *Vinsonia stellifera Westw.*—(The glassy Star Scale). Recorded by Douglas from Demerara in 1888 on Mango leaves. A very common species on the leaves of coconut and ornamental palms, French cashew Eugenia jambolana), citrus plants and several species of trees found in the interior forests of British Guiana. Its appearance is quite characteristic. being star-shaped, raised in the centre and of a hard glassy wax.

GENUS EUCALYMNATUS. CKLL.

45. *Eucalymnates perforatus. Newst*—(The tesselated Shield Scale). Found occcasionally on the leaves of cocos nucifera, and French Cashew, (Eugenia jabolana). A flattened insect, roughly ovate, of a dark brown colour with the surface distinctly tesselated.

GENUS COCCUS. LINN.

46. *Coccus hesperidum. Linn.*—(The Common Shield Scale). A common species on citrus plants and Liberian coffee (Coffea liberica). A small oval scale, green in colour, soft and invariably leaving a white mark when detached from the leaf.

47. *Coccus mangiferae. Green*—(The Mango Shield Scale). Recorded from Demerara by Douglas in 1888. A common species on the leaves of Jasmin (Eugenia paniculata) and mango. In shape roughly ovate, flat, green in colour with five black markings. No cottony wax secreted.

GENUS SAISSETIA. DEPLANCHES.

48. *Saissetia begoniae. Douglas.*—Recorded and described from Demerara in 1892, as a new species of Coccid on the under side of leaves of Begonia. The species has not been collected during recent years.

49. *Saissetia hemisphaerica. Targ.*—(The Brown Shield Scale). A common species on Liberian coffee (Coffea Liberica), citrus plants, guava (Psidium), several species of ferns.

Hexacentris coccinea. Loranthus, at times on crotons. Practically round, very convex, and of a light brown colour. Hard and shining exterior covering when fully mature.

50. *Saissetia nigra. Nietn.*—(The Hibiscus Shield Scale). Recorded by Douglas from Demerara in 1891. A very common species on the native rubber-producing tree (Sapium jenmani), Para rubber tree, (Hevea brasiliensis,) Ochroe, (Hibiscus esculentus), crotons, boulanger or 'egg plant' (Solanum melangeria), cotton plants, sunflowers (Helianthus sp.) and many other ornamental plants. Oval in shape and raised in the centre with a hard shining black exterior covering when fully grown.

51. *Saissetia oleae. Bern.*—A common species on citrus plants, Duranta, and a number of ornamental plants. Black or dark brown in colour, roughly circular in shape, the exterior covering bears an arrangement of ridges which roughly form the letter H.

A LIST OF CULTIVATED PLANTS WITH THE SCALE INSECTS THAT ATTACK THEM.

CITRUS PLANTS.

1. Chionaspis citri. Comstock. (The Orange Snow Scale).
14. Selenaspidus articulatus. Morgan. (The West Indian Red Scale)
15. Chrysomphalus aonidum. Linn. (The red-spotted scale).
16. Chrysomphalus auranti. Mask.
22. Lepidosaphes beckii. Newm. (The Orange Mussel Scale).
25. Parlatoria ziziphus. Lucas.
26. Orthezia insignis. Douglas.
33. Pseudococcus citri. Risso. (The Common Mealy Bug).
43. Ceroplastes floridensis. Comst. (The Florida Wax Scale).
46. Coccus hesperidum. L. (The Common Shield Scale).
49. Saissetia hemisphaerica. Targ. (The Brown Shield Scale).
51. Saissetia oleæ. Bern

PARA RUBBER. (Hevea Brasiliensis).

21. Chrysomphalns personatus. (Comstock).
30. Asterolecanium pustulans. Ckll. (The Akee Scale).
50. Saissetia nigra. Nietn.

COCONUT PALMS.

10. Aspidiotus destructor. Signoret.
34. Pseudococcus nipæ. Mask.
44. Vinsonia stellifera. West (The Glassy Star Scale).

SUGAR CANE.

12. Aspidiotus sacchari. Ckll. (The Sugar Cane Aspidiotus).
36. Ripersia sp. (The Sugar Cane Mealy Bug).
38. Pulvinaria. Sp.
33. Pseudococcus citri. Risso. (The Common Mealy Bug).

BANANA AND PLANTAINS.

4. Diapis boisduvalii. Signoret.
10. Aspidiotus destructor. Signoret.

CACAO.

33. Pseudococcus citri. Risso. (The common Mealy Bug).

COFFEE.

14. Selenaspidus articulatus. Morgan. (The West Indian Red Scale).
24. Ischnaspis longirostris. Sign.
46. Coccus hesperidum. L. (The Common Shield Scale).
49. Saissetia hemisphaerica. Targ. (The Brown Shield Scale).

MANGO.

6. Aulacaspis rosae. Bouché. The Mango Snow Scale).
47. Coccus mangiferae. Green. (The Mango Shield Scale).

EGG PLANT. (Solanum melangeria).

9. Aspidiotus cydoniae. Comstock.
35. Pseudococcus virgatus. Ckll.

FERNS.

33. Pseudococcus citri Risso. (The Common Mealy Bug).
43. Ceroplastes floridensis. Comst. (The Florida Wax Scale).

OCHROE.

50. Saissetia nigra. Nietn,

AVOCADO.

39. Pulvinaria pyriformis. Ckll. (The Mealy Shield Scale).
10. Aspidiotus destructor. Signoret.
21 Chrysomphalus personatus. Comstock

NATIVE RUBBER-PRODUCING TREE. (Sapium jenmani).

3. Howardia biclavis detecta. Maskell.
50. Saissetia nigra. Nietn.

ORCHIDS.

4. Diaspis boisduvalii. Signoret.
17. Chrysomphalus biformis. Ckll.
30. Asterolecanium pustulans. Ckll. (The Akee Scale).

COTTON.

7. Hemichionaspis minor. Ckll.
50. Saissetia nigra. Nietn.

BARBADOS CHERRY. (Malphigia glabra).

22. Lepiosaphes beckii. Newm. (The Orange Mussel Scale)
26. Orthezia insignis. Douglas.

CASTOR OIL PLANT.

1. Chionaspis citri. Comstock.

BAMBOO.

28. Asterolecanium bambusae. Bdv. (The Bamboo Scale).

AKEE.

30. Asterolecanium pustulans. Ckll. (The Akee Scale).

CROTONS.

50. Saissetia nigra. Nietn.
27. Orthezia praelonga. Douglas (The Croton Bug).
22. Lepidosaphes beckii. Newm. (The Orange Mussel Scale).
33. Pseudococcus citri. Risso. (The Common Mealy Bug).
49. Saissetia hemispherica. Targ. (The Brown Shield Scale).
51. Saissetia oleae, Bern.

Local Agricultural Shows.

WEST BANK.

THE following is an epitome of a report on this show held at La Grange on Wednesday, September 3rd, which was prepared by Mr. D. V. Jacobs, the late Superintendent of the Model Gardens. It is of particular interest as it is the last evidence we shall have of Mr. D. V. Jacobs' keen interest in agricultural matters especially in connection with technical work in primary schools. He died on October 11th and his untimely loss will be severely felt by the Board of Agriculture and this Department for many years to come.

The number of exhibits was the largest for the past five years as the following table shows :—

NUMBER OF EXHIBITS IN CLASSES.

Year.	A.	B.	C.	D.	E.	F.	G.	Total.
	Plants.	Fruits.	Vege-tables.	Econ. Prod'ts.	Poultry.	Cattle.	Forest Prod'ts.	
1909	3	227	166	189	41	6		632
1910	4	244	248	217	25	7	1	746
1911	1	269	202	235	19	12	1	739
1912		202	178	204	33	16	1	634
1913		436	254	210	20	13	1	934

The quality of the exhibits as a whole may be said to be quite up to the average. First place must, however, be given to the Economic Section, which was not only well represented, but contained some exhibits of very excellent quality, notably, among the manufactured articles.

The following is a detailed account of the exhibits as shown under the various classes.

CLASS A.—PLANTS.

There were no exhibits under this class. This is to be deplored, as it shows a lack of interest on the part of the farmers and others in the rearing of young trees to take the

place of the old ones, and to extend the areas now under cultivation. It will be noticed in the table given above that for the four previous years only eight entries of plants were made.

Class B.—Fruits.

This class, as is always the case at this show, was well represented, citrus fruits forming the largest group. I do not think, however, that they came quite up to the standard of previous years. The fruits were not so clean and fresh looking. Possibly this might be due to the attacks of blights and scale insects, evidence of which could be traced on the fruits themselves.

The Jamaica bananas were fine large bunches. The red or buck variety were of fair size and quality, while the Chinese or dwarf were only of medium size. Pine-apples, mostly of the Montserrat kind, were not as good as might be expected from this district, but possibly the prevailing weather conditions and it being rather late in the season may be accountable for this. There was a large collection of mangoes, but one or two exhibits were of the better kind. The rest were of the common varieties and for the most part over-ripe. Sapodillas, Star-apples (purple and green) were of ordinary size and poor. Of the two varieties of Melons, the musk was by far the better. They were very fine fruits. Two lots of grapes of the white kind, were fair size bunches, but they were not ripe. Sweet oranges were mostly of the thick skin variety and were of varying quality. Tangerine and Seville oranges were medium both in size and quality. There was a fairly good show of grape fruits, but bell-apples and mammie-apples, with one or two exceptions were rather poor. The same may be said of the Shaddocks. Limes were good, and so were Sicily Lemons. The Guavas were the common kind and poor. Coconuts were very good, and so were some of the Avocado pears. There was nothing special about the collection of mixed fruits, except perhaps a few peaches that were very fine. Jack fruits and bread fruits were small in size, the latter a poor lot. Of giant papaw there was none; the ordinary variety was good but somewhat over-ripe.

Class C.—Vegetables.

The number of exhibits in this class was the largest for the past five years; but the number of entries in some of the

items was disappointingly small and a few were disqualified for not complying with the terms laid down in the prize list. The majority of the plantains were of ordinary size, only two or three bunches coming up to exhibition standard. Of giant plantain there was none. Yams were fair and so were eddoes and sweet potatoes. Sweet cassava and bitter cassava were above the ordinary, but the best of them were disqualified for the reason stated above. Pumpkins also were particularly good, but they were not properly classified. The exhibits of the common kind of cucumber were many, but the greater number of them were old. Green corn, a fair number of exhibits, and the cobs were of fair size also, but they were too old to be called green. Dry corn, a fairly large lot and good Beans, green, in pods, were few and poor in quality. The following exhibits were good :—Tannias, eddoes, ochroes, eschalots. The others in this class do not call for any special mention.

Class D.—Economics.

This class contained a fairly large number of well prepared products. Of Creole Coffee there were several exhibits of excellent quality and the one that obtained the first prize was especially fine. There were many exhibits of Liberian Coffee of good quality also. It would be difficult to get better cocoa beans and pods in any part of the colony than were exhibited at this show. There was no award for white rice, and brown rice only secured a second prize. Rice flour got a special prize only as the exhibitor did not comply with the conditions as regards to quantity. It was, however, of excellent manufacture. No prize was awarded for cornmeal, the quantity in this case being short of the requirements, though the quality was good. The other meals and starches were excellent in quality, and would be hard to beat anywhere. There was a fine sample of banana meal for which a special prize was given. Of dried plantains and dried bananas there were several exhibits which were very good, but no prize was awarded to the latter as it was badly put up. Finer cassava bread than that entered for competition at this show can hardly be made in the colony. Tapioca was good, but honey was only fair. Leaf tobacco, hot sauce, prepared chocolate, castor oil, coconut oil, Cayenne pepper were all poor. Curry powder was fair and so was Kola. The Cotton, which appeared to be Sea Island, was of short staple. There were no entries of the following articles

in this section: Nutmeg, guinea corn, green ginger, dried pimento, Jams (Colonial made), Banana vinegar, pine-apple vinegar, Mango vinegar, fresh butter, and chutnee.

Class E.—Poultry.

Except for a pen of pure-bred fowls the exhibits in this class was poor. Out of eleven items entries were made in respect of five only and one was disqualified for non-compliance with the requirements.

Class F.—Cattle.

There was nothing special exhibited under this class. The heifers were certainly the best, and the sheep and she-goats were slightly above the ordinary. Of ten items only five were competed for.

Class G.—Forest Products.

Two exhibits of Hevea rubber grown in the colony were shown this year; both from the Canal I district. The samples were good, and it is to be hoped that the number of exhibits in this class will increase year by year to show what British Guiana can do in this direction.

School Gardens.

The school exhibits this year have surpassed those of previous years both in quantity and quality; and the teachers and scholars of the few schools that exhibited deserve credit for the excellent show they have made. As the Board of Agriculture supply the funds for the prizes won by schools and model gardens, I give below the number and value of the prizes (including the special prizes to the Head Teachers) and the schools that won them.

School.	No. of Prizes.				Total.	Value.	Special Prize to Head Teachers.	Amount.	Total.
	1st	2nd	3rd	4th					
Vaux-hall C....	7	8	1		16	$8 10	$4 00	$12 00	
Blanken-burg C...	4	4	3		11	$6 96	$4 00	$10 96	
Canal II. C	6	3	1		10	$5 18	$4 00	$ 9 18	$32 24

Model Gardens.

Five model gardens competed at this show; viz: Suddie, Wakenaam, Den Amstel, La Grange and Onderneeming Industrial School. The exhibits were very good. Tomatoes, Cabbages, Carrots, Artichokes and cucumbers were specially fine. The boxes of parsley were pronounced excellent by the judges. The boys at the Onderneeming Industrial School who for the past two or three years have been competing in this section, are to be congratulated on winning eight prizes which represent sixteen per cent. of the money value as the following statement shows :—

Garden.	Prizes.				Total.	Value.	Amount.
	1st	2nd	3rd	4th			
Suddie	3	5	3	3	14	$4 68	
Wakenaam	4	2	4	2	12	$4 32	
Den Amstel	2	2	2	2	8	$2 64	
La Grange	3	5	3	2	13	$4 56	
Onderneeming Industrial School	4	1	1	2	8	$3 24	$19 44

The Board of Agriculture displayed their usual fine exhibit of economic plants, fruits, etc., which attracted very considerable attention.

Great interest was also shown in an exhibit of injurious insects in glass cases and preserved in alcohol, also a series of photographs of the same subject which had been arranged by the Economic Biologist.

D. V. J.

BUXTON AND FRIENDSHIP.

Held Tuesday, August 19th.

This show was a decided fall back in regard to quantity, also in quality, except in a few cases. Of course it will be urged that the drought of last year had considerably to do with the scarcity of both fruits and vegetables but I think that statement will be considered far-fetched when it is remembered that the drought ended over a year before and

that for the greater part of the year ensuing the weather has been all that could be desired, as wellas the beneficial effect of the rest given to the soil consequent on the drought. Evidently a greater number of exhibits were expected as more provision was made to accommodate them than formerly, but as a fact the numbers were much less, insomuch as the tables in the schoolroom were very far from being fully occupied and could have accommodated more than was placed outside in the temporary shelters. It is stated that the idea of putting some of the vegetables on the stands in the open afforded more space in the school-house for moving about ;this was not the case, for the tables were placed exactly as they had been in former occasions and did not give one inch more room for this purpose ; in spite of the extra space provided the coconuts, though there were few, were still placed on the floor instead of outside, impeding the progress of the visitors. As there was plenty of unused space on the tables the removal of the outside exhibits was suggested so as to fill the tables and give the show a more completed appearance, but the suggestion was not acted upon. The heat was intense and so the vegetables placed outside suffered considerably through their exposure.

The Fruits.—There were no Jamaica Bananas though some were exhibited as such. This was a Barima variety known also as Surinam, only two exhibits. The Cavendish had three exhibits ; the Fig, one exhibit of three poor bunches ; the Red, three bunches, one of which was fair.

Pine Apples.—The best ever exhibited, made a good display of 23 lots. There were three kinds, though mostly of one variety, the Montserrat, very regular in form.

Mangoes.—Sixteen baskets of these were exhibited but they were indifferent and not what might have been expected, Buxton spice predominating.

In Citrus Fruits there was a great falling-off. Sweet Orange, 14 lots, not particularly clean fruits, though of fair quality, no thin skin kinds.

Coconuts, 8 lots, 3 with fair-sized nuts, some with immense fruits but very small nuts.

The Vegetables.—Plantains made a poor show for this District, there were but five lots and only three good bunches.

Pumpkins, one of the finest collections we have had in all our shows. Of the long or oblong there were 18 lots and of the flat there were 20 lots.

Economic Products.—Except in the meals, cassava starch and bread, this section showed up poorly, especially amongst the bottles. Creole Coffee, only two lots, one of which was Liberian.

The School and Model Gardens showed up exceedingly well and exhibited some good vegetables, better in many cases than those exhibited by the general public.

The Board of Agriculture Exhibits.—This was the most attractive object in the show as usual. The same four-sided pyramid stand was used as formerly and placed near the entrance, three sides in tiers of shelves filled with plants, fruits and economics and the fourth side filled with cleaned specimens of fibres.

In connection with this was an exhibit by the Economic Biologist which attracted considerable attention. This was composed of three cases of Beetles, Moths and other injurious insects, 15 vials of various caterpillars, etc., 1 large card of photographs of 35 objects of similar insects and three colour photos of moths, etc.

J. F. W.

Scientific Agricultural Re-search.

The recent advances in the theory and practice of Agriculture have come almost entirely from scientific research applied to agricultural problems. Accumulated results of centuries of painstaking studies have been drawn upon, and it has become evident that further improvement in agriculture calls for continued investigation of the most accurate and thorough nature. The first recognition of the economic value of progress in these investigations as well as the initial application of theories to practical problems comes usually from specialists. Indeed, only in rare instances is the significance of the results of scientific research apparent to farmers, since newly discovered facts are seldom directly applicable to agricultural conditions.

—B. T. Galloway, in the "Journal of Agricultural Research," Washington, D.C. U.S.A.

Mal de Caderas.

The following notes on Mal de Caderas have been extracted from the Experiment Station Record of the United States Department of Agriculture for the years 1902-1913 and comprise a record of all the published experimental work that has been carried out on this disease during that period. As Mal de Caderas has made its appearance in British Guiana these extracts will be of particular interest to readers of the Journal.

THE CAPYBARA AS A RESERVOIR FOR THE VIRUS OF MAL DE CADERAS, L. E. Migone (Bul. Soc. Path. Exot., 3 (1910), No. 8 pp. 524, 525; abs. in Sleeping Sickness Bur. (London) Bul., 2 (1910), No. 22, p. 413).—In Paraguay epidemics of mal de caderas in horses are frequently preceded by an excessive mortality of the carpincho, or capybara (Hydrochærus capibara) a large rodent which frequents the water. In a previous account, Elmassian and the author reported an epidemic among dogs that had hunted and eaten capybaras (E. S. R., 16 p. 716). In an investigation conducted by the author during the course of an epizootic among capybaras in April 1910, in which paralysis of the hind-quarters was the predominant symptom, trypanosomes were found in their blood for the first time. Monkeys (Nictipithecus felinus) injected with blood from capybaras showed trypanosomes on the fifth day and died on the seventeenth day with the same symptoms as observed in the capybaras to horses was not determined.

ALTERNATIONS IN THE BLOOD OF ANIMALS AFFECTED WITH EXPERIMENTAL TRYPANOSOMIASES, V. L. Akimoff (Arch. Sci. Biol. (St. Petersb.), 13 (1908), No. 3, pp. 243-276, pls. 2).—

The experiments reported by the author were made on various laboratory animals with cultures of the trypanosomes of nagana and mal de caderas

With regard to the effect of experimental inoculation of trypanosomes upon the blood, three periods may be differentiated. In the first period there is an increase in the total number of leucocytes, particularly the polynuclear cells, and a decrease in the number of lymphocytes. In the second period the trypanosomes appear in the blood and simultaneously there

is a decrease in the total number of leucocytes and an increase in the number of lymphocytes. The third period which in fatal cases occurs shortly before death is characterised by an increase in the number of polynuclear leucocytes and irregular variations in the relative proportions of the different forms of leucocytes.

MAL DE CADERAS IN DOMESTICATED AND WILD ANIMALS, M. Elmassian and E. Migome (Ann. Inst. Pasteur, 18 (1904), No. 9, pp. 587-589).—On a cattle ranch in Paraguay badly infested with capibaras, hunting expeditions were organised for the purpose of destroying these pests. It was noted, however, that on every occasion of this sort the dogs which killed and ate the capibaras became affected with mal de caderas and died. The same disease broke out also among the horses used for hunting. Laboratory experiments and microscopic tests showed the presence of the blood parasite of mal de caderas in all cases. It appears, therefore, that the capibara is frequently infected with the organism of mal de caderas and is capable of transmitting the disease to domesticated animals although itself suffering only on a mild form of the disease.

MAL DE CADERAS, O. Voges (Ztschr. Hyg. u. Infectionskran 39 (1902), No. 3, pp. 323-372, pl. 1).—The term mal de caderas is applied in South America to a disease of horses closely related to the tsetse fly disease. It is produced by a blood parasite known as Trypanosoma equina. The most conspicuous symptom is a lameness of the posterior extremities, but this symptom is not always present, and the simplest and surest method of diagnosing suspected cases is by inoculation of experimental animals with the blood of suspected horses.

The percentage of mortality from this disease is very high, reaching some 100 per cent. in some herds of horses.

The blood parasite to which the disease is due is described in considerable detail. Inoculation experiments with this parasite show that rats, rabbits, dogs, sheep, goats, guinea pigs, and poultry are susceptible to the disease, while cattle appear to be completely resistant. It is suspected that the blood parasite is carried by a biting insect, probably Musca brava, which is said to resemble in appearance the tsetse fly.

NAGANA AND MAL DE CADERAS AS TWO DISTINCT DISEASES, Alaveran and Msevil (Compt. Rend. Acad. Sci, Paris, 135 (1902), No. 20, pp. 838-840).—According to the authors'

opinions these two diseases are distinct, for the following reasons: There are constant morphological differences between Trypanosoma brucei and T. equinum; animals immunized against nagana are still susceptible to mal de caderas; and the serum of animals immunized against nagana is not active toward T. equinum.

THE AMERICAN SURRA OR MAL DE CADERAS, F. L. Sivori and E. Lecler (An Min. Agr. Argentine, Zoot. Bact. Vet y Zool., 1 (1902), No. 1, pp. 79, pls. 51).—The disease which passes under the name of mal de caderas has been known in different parts of South America, especially Brazil and Argentine, for a number of years. It is believed to have appeared first in the island of Marajo at the mouth of the Amazon. The earliest report concerning its ravages was made in 1860, and a number of outbreaks occurred during that time and recent years. The most serious outbreaks, however, have taken place since 1897. The authors describe in detail the symptoms of the disease as seen in spontaneous cases. Perhaps the most pronounced symptom is that of progressive anemia accompanied with irregular gait and partial paralysis of the posterior parts. There is usually an increased sensitiveness in the loins. So far as the authors have been able to observe the disease is uniformly fatal. A number of autopsies were made and detailed notes are given on the results of these examinations.

The Trypanosoma, which is the cause of this disease, is closely related to those which are already known to be pathogenic for domestic animals, but is believed to be distinct from reated species. Some days it may be found in large numbers inthe blood, and on other days it may be entirely absent. The cause of this great fluctuation is not well understood. Notes are given on the biology and morphology of this parasite. The blood organism is able to live in shed blood for at least four days. Agglomeration of the parasite was observed in preparations of the blood of badly infected horses, in the peritoneum of inoculated guinea pigs, and in the blood of infected cats. The organism may be transmitted artificially to horses, mules and various other species of mammals. The progress of the disease is rapid in rats, mice and monkeys, while it is considerably slower in horses, cats, guinea pigs, rabbits and dogs. In goats the disease appears to assume a chronic form, while birds and batrachia proved to be refractory. The disease appears naturally in horses and mules. The blood parasite may be transmitted by a species of Tabanus not determined,

by Musca brava, or by species of stomoxys. Mal de caderas is considered by the authors as being closely related to nagana and almost or perhaps quite identical with Asiatic surra.

MAL DE CADERAS, M. Elmassian (Ann. Inst. Pasteur, 17 (1903), No. 4, pp, 841-867, figs. 4).—This disease is due to the presence in the blood of the protozoan organism known as Trypanosoma equina. This organism is described in detail and notes are given on the most approved methods for fixing, staining, and studying it. Mal de caderas occurs in a number of clinical forms, the more common of which runs a tolerably rapid course. The disease also occurs in chronic and paralytic forms.

Notes are given on the symptoms that are characteristic of these different forms and upon the pathological lesions which are produced during the progress of the disease.

The liver, spleen, and pancreas become much injected and swollen, while the lymphatic system is not affected. In addition to the horse, mule and ass, which are most susceptible to the disease, a number of other animals may be infected, and susceptibility of these animals varies from that observed in monkeys to the absolute refractoriness of birds. Aside from the horse tribe, the susceptible animals are as follows: Monkey, white and grey mice, white rat, capibara, guinea pig, rabbit, dog, sheep, cattle, pig.

A STUDY OF THE DISEASE OF SOUTH AMERICAN HORSES KNOWN BY THE NAME OF MAL DE CADERAS, J. Lignieres (Contribution à l'etude de la trypanosomose des equides Sud-Americans connue sous le nom de "mal de cadera." Beunos Aires: 1902, Coni Brothers, pp. 120, pls. 3).—The author reviews in a critical manner the literature relating to this disease. Notes are given on the microscopical structure of Trypanosoma elmassiani, which is the causative organism of the disease. The author discusses also the method of multiplication of this organism, its abnormal forms, and the effect of various sera in agglutinating it.

In a long series of experiments it was found that agglutination of the pathogenic organism of mal de caderas could be brought about by the sera of normal sheep, pigs, rabbits, and horses, but more effectively by the sera of cattle, sheep, dogs, and cats affected with mal de caderas. As a rule agglutination

took place immediately, and then became more pronounced by a gradual process. The organism of mal de caderas when subjected to a temperature of 53° C. for 5 minutes or 45° for 3 minutes was killed. It withstood a temperature of 44° C. for 5 minutes, but was destroyed by the same temperature when applied for a period of 15 minutes. Subjection to temperature of 29° for 5 minutes destroyed a considerable percentage of the trypanosoma.

Experiments were also made with a number of antiseptic substances, such as carbolic acid, lysol, boric acid, corrosive sublimate, and permanganate of potash. In general the antiseptics had the effect of causing agglutination. The process was most pronounced after the use of potassium permanganate. An extensive series of inoculation experiments showed that a large number of animals are susceptible to this disease. The susceptible animals according to the author's experiments, mentioned in the order of their susceptibility, include white mouse, white rat, grey mouse, grey rat, dog, horse, rabbit, cat, sheep, cattle, dog, pigeon, duck, domestic fowl and frog. The method of infection by this disease has not yet been determined. The author suggests the possibility of the organism being carried by Stomoxys calcitrans. The blood of infected animals when taken from the stomach of this species of fly was found to contain the organism of mal de caderas in a virulent condition.

THE ACTION OF HUMAN SERUM ON THE TRYPANOSOMA OF NAGANA, MAL DE CADERAS, AND SURRA, A. Laveran (Compt. Rend. Acad. Sci. Paris, 137 (1903), No. 1, pp. 15-19.—Human serum when injected into animals infected with nagana has already been shown by the author to be very effective in destroying the blood parasite. Similar results have been obtained and reported in this article in experiments with surra and mal de caderas. The action of human serum was shown to be very similar toward all 3 species of Trypanosoma. When 0.5 to 1.cc. of human serum is injected hypodermically into mice inoculated with nagana, the blood parasites disappear within 24 to 30 hours.

NAGANA, SURRA, AND MAL DE CADERAS AS THREE DISTINCT DISEASES, A. Laveran and F. Mesnil (Compt. Rend. Acad. Sci. Paris, 136 (1903), No. 25, pp. 1529-1532).—Evidence is presented to show that these diseases are all distinct from one

another. They are due to 3 distinct species of Trypanosoma, viz., T. evansi, T. brucei, and T. equinum. Animals immunized against one species of Trypanosoma were found not to be immune to the other species.

VOGES'S DESCRIPTION OF MAL DE CADERAS, C. W. Stiles (U.S. Dept. Agr., Bureau of Animal Industry Rpt. 1902, pp. 411-416).—A brief summary of Voges's account of this disease, as presented in an article already noted (E.S.R. 14, p. 400.)

ANIMAL DISEASES, G. d'Utra (Bol. Agr. Sao Paulo, 4 ser., 1903, No. 8, pp. 351-374).—The author describes the symptoms and pathological anatomy of nagana, surra, mal de caderas, and dourine. Notes are also given on the differential diagnosis of these diseases and on the insects which are concerned in their transmission.

MAL DE CADERAS AFFECTING HORSES, G. d'Utra (Bol. Agr. Sao Paulo, 4 ser., 1903, No. 11, pp. 501-520).—The literature relating to this subject is critically discussed. Notes are given on the ordinary clinical forms of mal de caderas including the chronic and paralytic forms. The treatment of the disease is also briefly discussed and reference is made to the agency of insects in carrying the blood parasite.

MAL DE CADERAS IN SOUTH AMERICAN HORSES, J. Legnieres (Rec. M.ed Vet., 8 ser. 10 (9903), Nos. 8 pp. 51-69; 4, pp. 109-134 6, pp. 164-190, pls. 2).—This disease is due to infection by Trypanosoma elmassiani. Notes are given on the morphology of the organism and its various developmental forms. Special attention is devoted to a discussion of agglutination of the blood parasite and its behaviour toward antiseptics.

The vitality of the organism of mal de caderas differs greatly according to the medium in which it is grown. Agglutination takes place either in more or less irregular masses or rarely in the form of a row of beads. In general, agglutination occurs rapidly, but the phenomenon may disappear after a short period. The author made a number of experiments in inoculating animals with this organism and concludes that animals are susceptible to this disease in the following order: white mice, grey mice, white rats, grey rats, dogs, coati, horses, rabbits, cats, guinea pigs, sheep, cattle, pigs, eec. Notes are given on the development of the disease is these various animals and the differences between T. elmassiani and other species of this genus are described.

TREATMENT OF MAL DE CADERAS, M. S. Bertoni (Rev. Agron., Paraguay, 3 (1903), No. 7-8 pp. 238-240)—The author discusses briefly the use of arsenate of soda, arsenious acid, potassium permanganate, corrossive sublimate, quinine and other treatments. The transmission of the disease is believed to be accomplished through the agency of Stomoxys calcitrans.

TRYPANOSOMES AND TRYPANOSOMIASES, A Laveran and F. Mesnil (Trypanosomes et trypanosomiases. Paris. Masson & Co., 1904, pp. XI—418, pl. 1, figs. 61).—In this volume the authors have brought together a summary of accounts of their own and other author's investigations regarding the morphology and biology of Trypanosomes and the symptoms, distribution, and treatment of diseases caused by these organisms.

In a discussion of these problems numerous references are made to the literature of the subject. The volume contains chapters on the distribution of tryponosomiases, technique for the study of trypanosomes, the morphology of various species of trypanosomes, nagana, surra, mal de caderas, dourine, galziekte, trypanosomiases of man, birds, reptiles, amphibia, and fish. An account is also presented of the tsetse flies, with an analytical table for determining these.

THE BIOLOGY OF TRYPANOSOKES OF NAGANA AND MAL DE CADERAS, W. L. Jakimoff (Centbl. Bakt. (etc.), 1. Abt., Orig, 37 (1904) No. 5, pp. 668-678).—The author discusses in detailed manner the morphology and biology of Trypanosoma brucei and T. elmassiani.

It was found in inoculation experiments that the trypanosomes of nagana and mal de caderas cause an acute infection in mice and rats which lasts no longer than one week. In dogs, foxes, guinea pigs, rabbits, and cats the disease shows a slower course, while in goats it assumes a chronic form. Outside of living animals trypanosomes remain alive and maintain their virulence longest in defibrinated blood at a living temperature. Trypanosomes were found to be exceedingly susceptible to heat and disinfection.

A Fungus Disease of "Peppers" (*Capsicum spp*).

COLLETOTRICHUM NIGRUM. Ellis and Halsted.

By C. K. Bancroft, M A., F.L.S., Government Botanist, and R. L. Hunte, Agricultural Assistant.

During the past year the fruits of the varieties of "pepper" growing in the experimental area of the Botanic Gardens have been observed to be affected with a disease which appeared to increase so considerably in magnitude that the crop of a number of the bushes was rendered almost valueless.

The first appearance of the disease is a shrunken area on the surface of the fruit, occurring sometimes at the tip, but frequently at the side and usually making its apearance after the fruit has developed to about half its full size. The wall of the fruit becomes wrinkled usually in the form of concentric rings around the point of infection. The diseased area increases in size and becomes brown in colour. The whole of the fleshy part of the fruit is finally involved and frequently falls away from the stalk.

On the surface of the fruit, there appear black masses (acervuli), the fruiting portion of the fungus. These occur usually in concentric rings consisting of hyphæ bearing spores and also of sterile hyphæ or setæ of a dark brown colour. From these the fungus has been identified as *Colletotrichum nigrum*, Ellis and Halsted.

In addition to the destruction of the fruit there is distinct evidence that the disease works back to the shoots of the plant causing a dying back of the stems for a certain part of their length. Examinations of these stems were made and the hyphæ of a fungus were observed both in the pith and cortex.

Of the varieties affected some appeared to be very susceptible to the disease, such as the "long white" and the "long red." Others presented varying lesser degrees of attack; while some, such as the "red chilly" and the "long bird"

were unaffected. The attached list shows the result of observations on the degree of attack on the different varieties; A, B, and C denoting degrees of attack in order of sequence; O plants unaffected.

DISEASE (*Colleototrichum nigrum*) ON CAPSICUMS.

Numbers of Plants.

Variety	A. In A.	B. In B.	C. In C.	O.
Long white	10	3	1	0
Long red	7	8	6	1
Red wirriwirri	4	1	0	0
Red bird	4	2	2	0
Red bird, large	2	0	1	0
Red bonny	2	3	8	0
Large white bonny	1	0	0	0
Long pointed red bonny ...	1	0	0	0
Long small red bonny ...	1	0	1	0
Red bird X wirri	1	0	0	1
White bonny	0	3	1	0
Bongamanui	0	2	1	1
Long red bonny	0	2	0	0
Yellow round	0	2	0	0
Heavy long white	0	2	0	0
Yellow wirri-wirri	0	1	2	0
Red cherry	0	0	2	0
Small red bird	0	0	1	0
Large long red bonny ...	0	0	1	1
Red chilly	0	0	0	3
Long bird	0	0	0	1
Red bird X bonny	0	0	0	1

The nature of the disease suggested the destruction of diseased fruits and stems and the spraying of the young fruits with a fungicide as a possible means of control. All of the affected peppers were collected and destroyed and the affected stems were cut back as far as the healthy part. Spraying of the bushes was carried out by a knap-sack sprayer and Bordeaux mixture of two thirds the "normal" or 1.6 strength, in the ratio of copper sulphate 11 lbs., quicklime 7 lbs. and water 100 gal. was employed. The results which have attended it would indicate that it is a satisfactory method of control; since the last spraying few of the fruits have been affected.

Fungus Notes.

Leaf-spot of Orchid. The leaf becomes spotted with orange-coloured spots which later develop a dark-coloured centre. The spores of the fungus appear in clusters on the spots.

The species affected at the Botanic Gardens was *Phalænopsis esmeralda, Regnerii*, and the causative fungus *Uredo orchidis*, Wint.

Leaf-mildew of Rose. This disease was prevalent in the Botanic Gardens among certain of the rose bushes in the latter part ofof the previous year. It was confined to the leaves, the shoots and flower buds being unaffected. A delicate white mildew forms on the leaves, which becomes mealy from the production of the conidia of the fungus. The shape and size of the conidia agree with those of *Sphærotheca pannosa*, Lev, the cause of the common rose mildew. Dusting with flowers of sulphur was found to be effective in checking the disease.

C. K. B.

Mosquito Gauze.

The price of brass or copper wire gauze becomes heavy when the gauze perishes quickly, and in some damp climates this happens in a year. It has been suggested that a substitute might be obtained from flax thread, which can be spun very fine and at the same time strong. The scrim could be treated green by the Willesden process, as a protection against rot, at a cost of about 3d. per square yard; and materials so treated can be obtained at from 6¾d. to 14½d. per square yard. Such nets appear to stand exposure well, and have the advantage of being easily handled.

It has been found that the air within a mosquito net contains twice as much organic matter as the air outside. The net is in this way detrimental to health, and therefore the mesh should be as large as is compatible with safety.

—"The Colonial Journal."

Notes on Mal de Caderas.

By Capt. A. L. Farrant, F.R.C.V.S. Lond., F.R.V.C.M.A. Lond., M.R. San. I. Lond., late Vety. Officer, Royal Horse Artillery.

SYNONYMS :—Peste de caderas, (Brazil); Mal de caderas, Tumby-baba or Tumby-a (Paraguay, Argentine), Flagellosis of Equidæ ; Trypanosomosis of Equidæ, &c., &c.

Mal de caderas, a disease of the *rump*, or *hind quarters*, or more commonly loins. This disease is an epizootic of mules, and asses occuring in South America. The organism or trypanosome which is the causal agent of this disease was discovered by Dr. Elmassian, Director of the Bacteriological Institute in Asuncion the capital of Paraguay. The name of the organism is Trypanosoma Equinum named by Vosges of Buenos Aires, in 1901 shortly after its discovery.

The form and appearance of the trypanosomes are as follows :—

The body is elongated and usually blunt at one end with a flagellum at the other. Centrally there is a round or oval body, the nucleus proper. Behind this, and usually very close to the posterior end of the body, is a very much smaller body, the centrosome, blepharoplast or kinetonucleus. From this centrosome arises the flagellum which runs to the surface, emerges, and passing forward forms the border of the undulating membrane. This flagellum is longer than the undulating membrane, displaying a free portion which is usually as long as the entire body. The end from which the flagellum protudes is regarded as the anterior end.

Trypanosomes are parasites of vertebrates ranging from fishes to man, they are confined to the blood, lymph, or cerebrospinal fluid, and therefore, with one exception the intervention of an intermediate host is necessary for their transfer. In the case of certain of the mamalian trypanosomes the carrier is known to be a fly.

The transfer of trypanosomes by the invertebrate host is effected in two ways, the indirect or biological and the direct

or mechanical. The former is wholly analagous to what takes place in the transmission of malaria by mosquitoes The fly bites an animal sffflering from the disease, taking up a number of trypanosomes with the blood. These are not digested by the fly but go through certain biological processes, and may even apparently disappear as trypanosomes. At all events the fly after the first few hours, generally ceases to be ineffective, and remains none infective for several days. After this lapse of time, however, the trypanosomes within the fly resume their ability to infect any host which the fly may bite. Moreover, flies which have thus become infective remains so, so far as is known, for the rest of their lives, the trypanosomes continually multiplying within them. In the experimental work so far done, however, only a small proportion of flies from 5 to 20 per cent. acquire this permanent infection, although in nature it is believed the percentage is much higher.

The second method of transfer is the direct or mechanical. If a fly bites a sick animal, and very shortly afterwards a healthy one, the latter may contract the disease. This is due to the fact that as a result of the first bite the proboscis of the fly becomes charged with trypanosomes and these are deposited in the wound made when the fly bites for the second time.

The experiment has been tried of allowing a fly to bite a sick animal, and then successively two healthy ones. It has been proved that the first healthy animal to be bitten by the fly usually contracted the disease, whereas the second one did not, In other words, the fly cleaned its proboscis while biting the first of the two healthy animals. The ability to infect by the direct method is usually lost at the end of a few hours, but can be maintained for as long as two or three days.

In the transfer of an organism by the indirect method, while there may be more than one insect host, these, in the known cases, are closely allied species.

In direct transmission it apparently makes but little difference what species of the biting fly is involved, the essential condition being that the interval between the bites of a sick to an healthy animal be only a matter of a few hours. The fly merely acts as a scalpel or hypodermic needle. Indeed, it has been found that the house fly, which cannot bite at all, can transfer *Mal de caderas, Surra and other Trypanosome diseases by merely sucking alternately a raw surface on a sick and an healthy animal.*

Knowledge as to what takes place with the trypanosome in the intermediate host is meagre up to date. According to Laurda, Mal de caderas was imported into the island of Marajo, from there it spread as far as the state of Matto Grosso. This much is certain that since 1860 Caderas has caused such ravages in this particular state that horses and mules have all disappeared, and the natives are obliged to use cattle as draught animals and even for riding purposes, young bulls are trained. At the present time the disease has greatly extended; it occurs in Brazil and Bolivia throughout Paraguay, in the Argentine territories of the Chaco, Formosa, and Misiones, also the Argentine provinces of Corruntes Santiago del Estero, and Catamarca, the epizootic is most prevalent in the marshy districts and during the months that it rains hard.

ANIMALS SUSCEPTIBLE TO MAL DE CADERAS.

Caderas naturally occurs almost exclusively amongst horses, but by inoculation can be given to a larger number of other mammals.

Let us first study the disease in the horse and mule, since it is essentially a disease of the Equidœ, and in them may give rise to very serious epidemics.

We have already seen that in certain parts of South America it is so difficult to keep horses and mules alive that cattle have to be used for riding purposes. Vosges mentions the case of a cavalry regiment which in June received 600 horses, of which only 100 were alive in the following November. Mules and donkeys, especially the latter, are more resistant than horses.

SYMPTOMS OF THE DISEASE.

1. The first sign of the disease in horses and mules is Lachrymation weeping or tears from the corner of the eyes running down the face, this at first is slight, but in a great number of cases increases in amount until it becomes profuse; there also appears at the inner canthus a semigelatinous secretion.

2. Petichiœ or rechymosis of the mucous membranes chiefly those of the membrana nictitans, which is of a claret colour, ranging from 1-16th to 1-4th of an inch, there may only be one or several, and, as the disease progresses they increase in

size, and coalesce To observe these changes the lids of eye must be everted. *(This is very characteristic in the early stages.)*

3. Irregular fever, temperature 104 F. to 107 F. which only lasts for very short periods, during which the trypanosomes can be usually found if smears of blood are taken upon glass slides.

4. Urine voided tinged with blood in great number of cases, more so in the females of the present epidemic ; this is known as hæmaturia. All authorities on this disease agree in stating that the organisms are not found in the urine even when the animal is affected with hæmaturia.

5. Penis projected from sheath for about 6 or 8 inches, with slight erection, and the organ bent to either one side or the other, this condition is continuous in animals thus affected.

6. The skin, particularly of the neck and shoulders, is often the seat of slight weeping eruptions ; the patches, which are 1 1½ inches in diameter, are covered with small scabs, and the hair falls out in those places. It is probably due to the presence of these patches, that upon all the estates where the epidemic has fallen, that there has been an increase to an enormous extent of collar galls, and harness sores in spite of extra precautions to prevent it, and the mules doing less than their usual work.

7. Paresis or loss of power to control the hind limbs in the later stages is characteristic ; although microscopical examination of the blood at this time fails to reveal the presence of the organism, but if injected into susceptible animals, a typical infection results. The disease is almost always fatal to horses ; it lasts from 2 to 5 months in the horse, 6 to 12 months in mules and asses There is rapidly advancing anæmia emaciation, and great debility, although in the great majority of cases the appetite remains good throughout, no matter how high the fever may be. There is extreme pallor of the visible mucous membranes, followed a little later by a yellow tinge. From first to last there is a progressive wasting.

8. The severity and course of the disease depend a good deal upon the age and breed of the animal ; for example,

young mules that appear to have taken more to the equine or horse side of their breeding are less resistant to the disease, than adult healthy mules of commoner breed.

MODE OF PROPOGATION.

Mal de caderas can be very easily inoculated, a very small dose being sufficient, or to place traces of the virus upon the surface of a wound or excoriation. The ingestion of blood or an emulsion of an organ containing trypanosomes is not followed by infection, if there be no recent wound or abrasion of the mucous surfaces. Sexual intercourse does not give rise to infection, as in the case of Dourine or Mal de Coit an allied trypanosome disease of horses.

One would naturally imagine that Caderas was spread by means of biting flies, as in the case of Surra, and Nagana. This opinion has been held by nearly all observers, but is still denied by some, and it is not in agreement with the number of recorded facts as to the conditions under which Caderas is propogated. Personally I believe the Stomoxys calcitrans which is so prevalent in every stable, pen or byre, in the colony is the chief means of the spread of the present epidemic.

(Legnieres states.) An epizootic of Mal de caderas which occurred on a farm in Paraguay did not spread to a neighbouring farm, which was separated from the former only by a wire gauze partition.

The only fact upon which all observers are agreed is that the capybara (Hydrochœrus capybara) or Caprincho, which is very abundant in Paraguay and in the Argentine portion of the Chaco, along the banks of the small watercourses running through the cattle-rearing districts is the source from which the flies or other carriers of the disease probably obtains its virus. These animals are attacked periodically by an epizootic of an unknown nature. They lie about along the banks of the streams and die there.

When the farmers in Paraguay find the dead bodies of the capybara on their farms, they know that Mal de caderas will soon break out among the horses. There is a striking analogy between this mortality among the capybaras which precedes outbreaks of Caderas, and that among rats which precedes epidemics of plague. (Capybaras are, the waterhass of this

colony, and are fairly common upon some of the sugar estate at present affected with Mal de Caderas).

PROPHYLAXIS AND TREATMENT.

Veterinary surgeons, Estates managers, and horse proprietors should see that all animals are daily dressed with the following, in the morning for preference. With a view of keeping their animals free from the various flies, and thus to some extent preventing the animal from becoming infected.

Kerosine	...	...	1 gallon.
Water	...	...	2 gallons
Soap (soft or hard)	...		1 lb.

Dissolve the soap in the water and add with continual stirring whilst water is boiling, the kerosene; allow to cool, and then brush into coat of animal with body or dandy brush.

Quinine, methylene blue, salycilic acid, carbolic acid, permanganate of potash, boracic acid, also intravenous injections of perchloride of mercury have all been tried in the treatment of this disease. As with Nagana and Surra, arsenious acid has given favourable results in some cases, but the improvement has only been temporary. Nuclein gave excellent results for a time but later did not appear to exert any beneficial effect on the diseased animals. Salvarsan or 606 proved to be useless, the animals upon whom it was tried quickly succumbed. Intravenous injections are being made upon some 30 animals, but at this stage, it is too early to be able to offer any opinion, either for or against the treatment to which they are being subjected.

At a later date, I hope to be in a position, to offer some further information on the subject, to the qualified veterinary surgeons, regarding the intravenous treatment for the relief of Caderas.

In animals found to be affected with the disease, before they have be come very low in condition I have had most excellent results by the administration morning and night of a mixture of Pot iodide and Hydrag biniod, particulars as to doses, &c., &c., I shall be most pleased to forward to any qualified brother practitioner; the animal while undergoing the treatment must be relieved from work of all kind, neither riding or hauling being permissible, as the animals appear to be unfit to cope with the disease and work at the same time.

Froghoppers.

By F.W. Urich, Entomologist, Board of Agriculture, Trinidad.

Cercopids, Spittle insects or froghoppers are insects belonging to the true bugs. They take their food in all stages of their lives by sucking the juices of plants. They are fairly well represented in South and Central America, but although Fowler lists 36 species of Tomaspis in the Biologia Centrali Americana only a few have made themselves conspicuous by their attacks on sugar cane and grazing grounds. In Mexico *Tomaspis postica* is a pest of sugar cane and grass and causes much losss to sugar cane planters and to those engaged in stock raising. *Tomaspis postica* has also been reported as a sugar cane pest in British Honduras The Trinidad froghopper *Tomaspis varia* is the principal enemy of the sugar cane in that island. Lately an undetermined froghopper has been forwarded to the writer from Columbia, where it was reported as doing damage to pastures by attacking the grass. In Demerara although there are several species of *Tomaspis* only *Tomaspis flavilatera* has been found on sugar cane, not however in sufficient numbers to be called a pest. As this species is allied to *Tomaspis postica*, the life history and methods of attack are not likely to differ essentially from those of the Trinidad insect, an account of which follows.

LIFE HISTORY.

Like all insects with incomplete transformations the froghopper passes through two stages before attaining maturity, namely, the egg and young stage commonly called the nymphal stage, there is no pupal or resting stage as occurs in the life of the giant Moth-Borer (*Castnia licus*). From the time the young nymph hatches from the egg to the development of the adult or winged stage, the froghopper sucks the juice from its host plants which consist of grasses of various species and sugar cane. The nymphs confine themselves mostly to the roots and the adults attack the tender leaves. The eggs are laid in dead or withering cane and grass sheaths so long as they are damp, but should the vegetation be dry the female froghopper chooses damp soil for her eggs, and appears to prefer clay of the consistency of cheese. The egg is very small and

torpedo-shaped measuring 0.80 m.m. in length and 0.24 m.m. in width. When newly laid it is of a yellow translucent colour ; as development proceeds it becomes white and a black V-shaped process is formed near the top which is a hatching lid or as some Hemipterists term it an egg burster. In rainy weather the eggs hatch in about 12 to 20 days, but in dry weather they remain dormant for months hatching at the opening of the rainy season. The young nymph which is wingless attaches itself to the grass and cane rootlets by means fo its beak or proboscis and commences to surround itself with the characteristic spittle in which it undergoes its whole transformation. After hatching the young nymph passes through four stages before issuing as a perfect winged insect. The nymphal or spittle stage lasts from 32-42 days. The adults leap and fly about at dusk and during the night, but in the day time they may be found hiding in the unfolding leaves of grasses and canes which they puncture and from which they extract the sap by sucking Copulation generally takes place on the same day that the female issues. She lays all her eggs in about ten days and on an average, deposits 50 eggs. The male dies 2 or 3 day after copulation, but the female survives for about 21 days. The entire life cycle of the froghopper during the rainy season occupies a period of 80 days which may be summarised as follows :—

Incubation of egg	20 days.
Nymphal period	40 ,,
Life of adults	20 ,,

In four wet months one female is capable of having a progeny of 20,000.

NATURE OF DAMAGE AND APPEARANCE OF ATTACK

The froghopper damages its food plant by sucking its juices both in the young and adult stages. The damage to canes is done principally to the roots by the nymphs. Adults feed on the leaves, but they alone are not capable of causing the leeavs to dry unless the plant is very young. The damage done to canes goes by the name of " Blight " in Trinidad and consists in a withering of the leaves and a stunting of the stem of the cane. According to the severity of the attack some or all of the leaves are withered, the outer ones withering first. The first symptom that the cane plant is attacked is an unnatured trans-

parency of the leaves especially the outer ones, the result of the feeding of the nymphs on the roots; as the attack increases and the adults appear, the edges of the leaves dry up, become yellow, then brown and curl inwards. When the first transparency shows itself the growth of the stalk stops. The nymphs puncture the young roots and once attacked they always die, as the nymph generally exhausts the sap they contain. Besides depriving the leaf of its sap the nymph injects some salivary secretion into the wound which causes the excessive acidity always found in blighted canes. The damage varies considerably according to the state of the growth of the canes. In some instances large acreages are completely destroyed, in others the fields only give half the usual yield. All varieties of canes are attacked, but some seem to suffer less than others.

CONTROL.

In all methods of artificial control it is essential that it be done at the commencement of the rainy season so as to destroy the first broods. In Demerara conditions are different from those of Trinidad, but in that island the spread of froghoppers can be restricted by weeding, burial or removal of trash containg eggs and covering abondoned or resting fields with leguminous cover crops. Besides other considerations, weeding of young plant canes is of great importance as far as froghoppers are concerned as it means depriving young nymphs of grass, as they are unable to easily attack the young canes. In the rainy season most of the eggs of froghoppers are laid in the cane trash, it is therefore important to pay special attention to trash containing eggs and either burn it or remove it to the pens. Bengal bean and wooly pyrol have given good results as cover crops. Other methods of control consist in crushing the nymphs in the field and using trap lights for adults. The light however must be one of low intensity such as that of a hurricane lantern. In connection with natural control the froghopper is preyed upon by the Scissor tail fly catcher (*Milvulus tyrannus*) and the "Ani" (*Crotophaga ani*) both of which birds devour adults; the ground lizard (*Ameiva surinamensis*) is partial to nymphs and adults, toads also eat froghoppers in these stages; spiders are efficient checks on adults and among the insects we have the vermilion egg parasite (*Oligosita giraulti*) and several species of ants that prey on nymphs when they leave their spittle covering. A Syrphid fly (*Salpingogaster nigra*) is an efficient predator the

larvae of which enters the spittle masses and devours nymphs. Adults and nymphs are often killed by an internal parasitical worm. Froghoppers ase also subject to two fungoid diseases, the Green Muscardine, *Metarrhizium anisopliae*, and a species of *Empusa*, the former of which is a very efficient check when occurring naturally and when the spores are cultivated artificially and dusted over the field.

CONDITIONS IN DEMERARA.

From what I have seen in the writings of Messrs. Bodkin, Quelch and Moore, there are only three species of froghoppers common in cane-growing districts, viz :—The Black froghopper *Tomaspis pubescens* which has never been found on cane and lives only on certainspecies of grass, the yellow-banded froghopper *Tomaspis rubra* which does not attack Gramineae at all, but lives on the Christmas Bush, *Eupatorium odoratum*, and the yellow-sided froghopper, *Tomaspis flavilatera*. This last name species has been found on sugar cane, but as far as I can gather never in sufficient numbers to cause damage. It should however be watched. It is very likely controlled by natural enemies ; these should be encouraged and protected as much as possible. It is likely that most of the birds, lizards and insects enumerated from Trinidad occur also in Demerara. No burning of fields should take place as the natural enemies are destroyed and the eggs of froghoppers escape. The flooding of affected fields would also be a valuable means of control at the disposal of the Demerara planters.

The Effect of Tides and Rainfall on the Breeding of Salt Marsh Mosquitoes.

Although rainfall is a factor in the abundance of mosquitoes, it does not necessarily follow that the more rain the more mosquitoes. So far as salt-marshes are concerned the time and amount of the precipitation are of great importance. A rain-storm occuring when the tides almost reach the flood line may be sufficient to raise the water-level so that a brood is produced ; while at another period, when the tide is low, the same amount of rain may be carried off without its first covering the marsh. Rain may at times actually prevent breeding by giving enough moisture to cause the eggs to hatch, but insufficient water for the needs of the larvae. Investigations of the relations of the tides and rainfall to the breeding of salt-marsh mosquitoes are far from complete.

—Journal of Economic Entomology. August, 1913.

Entomological Notes.

Parasite Determination.

We have recently received, through Mr. W. D. Hunter, of the United States Bureau of Entomology, from A. A. Girault, who is at present in Australia, the determination of the tiny yellow egg parasite of the small moth-borers (*D. saccharalis* and *D. lineolata*). The specimens he examined were bred here from parasitized egg clusters obtained from several sugar estates. He pronounces it to be *Trichogramma minutum*. Riley.

A New Pest of Soursop. (*Anona muricata*).

The larvae of the Lasiocampid moth, *Claphe lasconia. Druce*, are frequently found in numbers destroying the foliage of this cultivated plant. They are distinctly gregarious concealing themselves during the day under a thin net-work of silk and emerging at night only to feed.

Notes on the Sugar Cane. Mealy Bug. (*Ripersia* sp.)

This insect has not definitely been determined by Prof. R. Newstead of the Liverpool School of Tropical Medicine and it was known formerly as *Pseudococcus calceolarie. Mask.* The ova, which are concealed beneath the body of the adult female in a cottony mass, are light yellowish pink in colour, elongately oval and under high magnification show irregular reticulations (very fine in texture) on the surface.

Average measurements :

Length. 3.7 mm.
Breadth. 1.3 mm.

The ova appear to hatch gradually, complete hatching of all the ova takingin one instance 12 days. In 9 adult females the average number of larvae hatched during 12 days was 871.

The copulation of this species was observed quite accidentally when search was being made for mealy bug in a cane piece. On removing the cane sheath a small cluster of these insects was observed beneath (their usual habitat) and a male apparently just com mencing to copulate. The male of this species is but seldom seen for they conceal themselves as much as possible beneath the copious waxy secretions of the females.

The male insect is of course winged and yellowish brown in colour. The comparison in size between the two insects is quite absurd, the male not being much more than 2 mm. in length while the female was quite 7 mm. When primarily observed the male was clinging to the posterior end of the female, his front pair of legs being clearly visible on the upper surface and the hind pair of legs were holding more to the underside of the female. The female was observed to raise the posterior end of her body towards that of the male so as to assist him in his operations. As soon as connection was established both insect became motionless. The actual period of copulation lasted just over one minute when the positions were immediately relaxed and the male moved rapidly away.

Egg Parasites of Brassolis Sophorae.

In Vol. III., No. 1 of this journal mention was made of a pupal parasite (*Chalcis annulata, F.*) of this well known coconut palm pest which had been recently obtained. From a number of egg masses of Brassolis two species of egg parasites have lately been bred in this laboratory, both are apparently a species of Telenomus.

Occurrence of Castnia licus.

The adult moth has recently observed to be exceedingly prevalent in the Pomeroon River District. On one large coconut plantation some 50 adult moths were counted while traversing a half mile of the main dam. These were flying in the bright mid-day sunshine after a short shower of rain. At Issororo in the North West District a number of the adult moths were observed flying about a clump of wild plantains (*Heliconia erecta)* and several excellent specimens were taken.

Information was obtained through Mr. A. A. Abraham, the Resident Instructor, that the larva of this insect was frequently discovered when clearing land on which these plants grow.

The adult moths from this habitat are much larger in size than those bred from sugar-cane.

Hints, Scientific and Practical.

The Sterilization of Seed.

Summary :—The spores of fungi, and some kinds of bacteria are as a rule killed by an hour's immersion in hydrogen peroxide; no spores experimented with germinated after similar treatment for two hours.

In nearly every instance the germination of seeds immersed in hydrogen peroxide was retarded. Seeds immersed for four hours were on the average one to two days later in appearing above ground than untreated seeds of the same kind. Seeds treated for twenty-four hours were retarded by from two to eight days, or in most instances were killed outright. The period of retardation is much less in seeds which germinate quickly than in the case of seeds whose germination is normally slow. After treated seeds have germinated growth is rapid, and in a short time the plants are equal in size and vigour to the plants of untreated seeds sown at the same time. In some cases the plants from treated seeds are distinctly larger than those from untreated seeds at the end of three weeks. For all partical purposes, soaking seed in hydrogen peroxide for three hours will kill all superficial fungus spores and the seed will not be injured. This method is to be recommended as a substitute for fumigation, which, as a rule, does not kill fungus spores, unles continued for such a time as to damage the seed.

—Ivy Massee in the Journal of the Board of Agriculture of Great Britain, December, 1913.

The Hand-in-Hand Pig Club.

There are in Spalding, England, and its neighbourhood a number of pig insurance clubs, among which one of the most successful is the unregistered Hand-in-Hand Club, which was founded in 1888, mainly at the instance of a local auctioneer, who acts as treasurer to the club. The number of members increased in the ten years ending with 1911 from thirty-four to forty-eight; they are mainly working men, who insure one or two pigs each. Some of them keep two pigs, one to be eaten by themselves and families, and one to be sold to help

to pay the rent The number of pigs insured has increased in the ten years from forty-four to seventy-two, an average of 1.5 pigs per member.

For the ten years the number of pigs insured amounted to a total of 641, and the number on which claims were paid by the club was fifty-two, an average death-rate of 8.1 per cent. per annum. In the best year the death-rate was only 1.9 per cent. per annum; and in the last year, which was the worst of the ten, it rose to 16.6 per cent., a very high rate. When a new member insures a pig, and the pig dies within eight weeks, the club pays 3s. 6d. in the £ on its value; if it dies after eight weeks the club pays half its value; and if it dies after three months it pays three-fourths of its value. But an old member, who has been paying regular insurance contributions, is paid three-fourths of the value of the pig without regard to the time during which that particular pig has been insured, so that in most cases the club is liable of three-fourths of the value of any pig that may die owing to disease or accident. Until two years ago the compensation payable was 17s. 6d. in the £, but, owing to the diminution of the funds, the maximum sum payable has since been reduced to 15s. in the £ on the value of the pig at the time it falls ill.

—The Journal of the Board of Agriculture of Great Britain, December, 1913.

An Interesting Soil Water Question in British Guiana.

Some years ago, Harrison first called attention to the markedly alkaline condition of the soil water underlying the sugar estates fringing the coast of British Guiana, and its pernicious effect upon the growth of the sugar cane; and since this interesting problem is one to be very appropriately recorded in the pages of this Journal *; the writer has prepared the following brief account of it.

The appended analyses are typical of the sugar soils of British Guiana, and indicate their wonderful fertility from a standpoint of plant food. The yield and quality, however, of the cane grown upon them is very often disappointing, and this is due to the fact that, many of these lands lying below sea-

* The Journal of Industrial and Engineering Chemistry.

level, deep and thorough drainage is well nigh impracticable, with the results that as the soil slowly and continuously decomposes, the surrounding and underlying water becomes charged with alkaline mineral matter, the product of this decomposition, and this alkaline material entering through the roots, acts in a very deleterious manner upon the juice of the cane.

	Soil from Pln. Albion Berbice, (Coastal estate).	Soil from Pln. Friends, Berbice, (River estate).	Soil from Pln. Hamp ton Court, Essequibo, (Coastal estate).
Water and volatile matter ...	18.050	19.660	14.503
Insoluble matter ...	66.250	65.609	66.915
Iron and aluminum oxides ...	13.780	14.503	17.496
Lime ...	0.345	0.134	0.316
Magnesia ...	0.629	0.431	0.504
Potash ...	0.458	0.495	0.501
Phosphoric acid ..	0.248	0.256	0.224
Nitrogen ...	0.172	0.351	0.196

Note.—Though weighed as ferric oxide some of the iron in these soils is in the ferrous form.

The excess of magnesia over lime in the above is very noticeable, and this appears to be the case throughout in the alluvial soils of the colony.

Coming now to the soil waters, the writer examined a great many under varying conditions of rainfall, etc., finding the alkali, as determined by titrating with decinormal sulphuric acid, to range from a trace to 480 parts per million of water, when calculated as sodium carbonate; while the total mineral matter, determined by evaporation of the water, rose to over one per cent. of the water. This saline material entering the roots of the growing cane was found to produce from three to five times the quantity of ash in the juice that is found in the juice of cane grown on well drained soils. This ash, or mineral matter, of the juice concentrating in the molasses from the process of the sugar factory was found (as so lucidly described by Geerligs) to form uncrystallizable compounds with the sucrose, whereby much sugar is lost. In order to break up these compounds and render the sugar available it becomes necessary to employ some such method, as osmosis or the stiffen process, as is in use in the best sugar industry.

Since the soil water contains a large proportion of magnesia, which in the cane-juice exercises an especially deleterious effect in restraining the crystallization of sugar, the experiment suggested itself to the writer of precipitating the magnesia from the soil water with a solution of hydrate of lime. As this proved highly successful, large quantities of lime (from two to three tons per acre) were applied to a large tract of sugar lands, with the result that the juice of the subsequently grown cane was very markedly improved.

Summary :—One of the chief obstacles to profitable sugar production in British Guiana is the highly saline character of the soil water, to overcome which every effort should be made to achieve deep and thorough drainage, which can be most advantageously supplemented by heavy applications of slaked lime to the land. Where these remedies are not practised a large loss of sugar in the factory can be obviated only by employing a special process, such as either of those indicated above, to separate the sugar from the abnormal quantity of mineral matter present.

—Maurice Bird in the Journal of Industry
and Engineering Chemistry, December, 1913.

The Utility of the Bat.

In Texas, experiments have been made with the object of cultivating bats for the production of guano, and at the same time for the control of mosquitoes. It has been found that a structure large enough to hold 50,000 bats would cost considerably less than £2,400 and that would yield in a year 20¼ tons of guano of an average value of £121 10s. During the experiments, enquiries made in the district, of the heads of fourteen families, showed that a number of mosquitoes had abated remarkably, and that the fever which was previously rampant had almost entirely vanished. It is therefore concluded that it is not only commercially, but hygienically profitable, to cultivate bats.

—The Review of Applied Entomology, October, 1913.

The Model Gardens.

Record of Attendances.

Below is given a table, arranged in quarterly periods setting out the number of pupils who attended the Model Gardens of the colony from April 1, 1907. These quarters (recorded below as 1st, 2nd, 3rd and 4th) run from January 1 to December 31. The totals only during 1907, 1908 and 1909 are given; the records since then are in detail.

Quarters.	Bourda.	Charlestown.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	La Grange, W. Bank, Dem.	Suddie, Essequibo.	Den Amstel.	Houston, E. B.	Wakenaam.	Total Attendances.
1907.										
2nd–4th	1,261	928	994	835	556	...	...	...	...	4,574
1908.										
1st–4th	5,447	3,386	1,477	887	1.053	160	...	...	...	12,410
1909.										
1st–4th	6,473	2,665	1,738	1,277	1,192	1,897	662‖	...	...	16,904
1910.										
First	1,282	769	287	370	259	489	465	..	...	3,921
Second	1,311	558	787	894	303	455	519	403§	...	5,240
Third	¶1,234	526	910	748	294	510	498	537	...	5,257
Fourth	1,209	444	1,285	336	295	493	502	592	...	5,156
1911.										
First	1,086	360	1,042	838	312	514	414	572	577	5,695
Second	1,263	326	713	816	286	292	536	591	688	5,511
Third	¶ 1,093	385	910	627	361	297	543	441	639	5,296
Fourth	1,687	448	935	588	447	406	737	957	540	6,745
1912.										
First	1,127	379	1,374	1,034	425	207	573	359	423	5,901
Second	1,385	359	1,096	900	484	553	730	461	413	6.381
Third	1,416	400	763	889	412	572	621	616	443	6,132
Fourth	1,586	254	1,162	479	459	768	620	720	439	6,487
1913.										
First	1,613	464	1,060	637	529	764	661	464	342	6,534
Second	1,273	498	1,368	863	517	766	653	508	401	6,847
Third	1,176	495	904	670	498	945	736	475	333	6,232
Fourth	1,094	505	1,203	349	451	924	518	389	243	5,576

Note.—The figures for the Country Model Gardens quoted above refer only to the numbers present during instruction given by the Superintendent Teacher. It has not yet been found feasible to keep reliable, full records of the very numerous attendances during his absence

¶ Schools in vacation during August.

‖ Instruction commenced in July.
§ Instruction commenced in April.

Exports of Agricultural and Forest Products.

Owing to a clerical error the list of Agricultural and Forest Products exported up to October 13th, 1913, were mis-stated in the October issue of the Journal. A corrected list is given below.

Product.	1910.	1911.	1912.	1913.
Sugar, tons ...	46,920	52,835	32,736	37,670
Rum, gallons ...	1,626,480	1,542,067	1,504,467	1,681,084
Molasses, casks ...	631	879	906	gallons 76,202
Cattle-food, tons ...	4,751	3,287	3,111	5,313
Cacao, cwts. ...	443	798	102	364
Citrate of Lime, cwts.	76	56	5	6
Coconuts, thousands	681	682	943	528
Copra, cwts. ...	210	1,038	963	745
Coffee, cwts. ...	978	925	1,225	727
Kola-nuts, cwts. ...	9	...	...	2
Rice, tons ...	4,141	1,883	2,365	5,678
Rice-meal, tons ...	1,555	974	1,484	1,651
Starch, cwts. ...	4	...	..	...
Cattle, head ...	1,049	832	434	631
Hides, No. ...	4,574	3,152	3,025	4,026
Pigs, No. ...	872	1,013	997	1,214
Poultry, value... ...	$ 67 98	...	...	..
Sheep, head ...	122	40	61	22
Balata, cwts. ...	6,570	5,712	2,287	5,868
Charcoal, bags ...	71,222	55,956	52,099	43,761
Firewood, Wallaba, etc., tons ...	7,509	8,130	7,320	6,598
Gums, lbs. ...	1,507	3,246	3,041	1,515
Lumber, feet ...	202,027	310,131	155,423	422,509
Railway Sleepers, No.	5,700	3,920	4,046	6,718
Rubber, cwts. ...	12	23	2	5
Shingles, thousands	1,802	2,035	1,667	2,020
Timber, cubic feet	222,681	161,556	244,940	391,683

Exports of Agricultural and Forest Products.

Below will be found a list of Agricultural and Forest products of the colony exported during 1912. The corresponding figures of the three previous years are added for convenience of comparison :—

Product.	1910.	1911.	1912.	1913.
Sugar, tons ...	106,439	98,459	77,788	87,414
Rum, gallons ...	2,005,873	2,595,293	2,382,937	3,260,986 gallons.
Molasses, casks ...	2,084	1,106	1,760	118,699
Cattle-food, tons ...	9,379	5,556	5,116	6,859
Cacao, cwts. ...	472	798	102	505
Citrate of Lime, cwts.	87	56	½	35
Coconuts, thousands	994	1,038	1,042	872
Copra, cwts. ...	306	1,415	1,149	1,127
Coffee, cwts. ...	1,049	927	1 293	797
Ground Provisions, value	$546 12	...	...	...
Kola-nuts, cwts. .	9	4	...	1
Rice, tons ...	4,927	2,538	2,721	7,709
Rice-meal, tons ...	1,620	1,364	2,005	1,802
Starch, cwts. ...	4	...	...	...
Cattle, head ...	1,210	953	497	965
Hides, No. ...	5,569	4,617	4,230	5,106
Pigs, No. ...	1,090	1,148	1,159	1,604
Poultry, value ...	$ 72 36	...	...	...
Sheep, head ...	123	40	71	40
Balata, cwts. ...	11,302	10,289	6,296	11,817
Charcoal, bags ...	76,681	72,937	67,573	62,321
Firewood, Wallaba, etc., tons ...	10,192	9,866	8,759	8,670
Gums, lbs. ...	2,529	4,652	4,958	2,237
Lumber, feet ...	277,313	327,328	223,751	517,819
Railway Sleepers, No.	2,950	5,432	5,280	11,020
Rubber, cwts. ...	14	32	2	11
Shingles, thousands	2,463	2,500	2 562	2,645
Timber, cubic feet	278,382	234,003	284,530	437,111

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Soil Treatment.

Agriculturists in British Guiana are far too prone to regard their soil as a quantity which with a minimum of attention will perform all that is required and possibly more. Tillage often consists in the surface of the soil being slightly scratched, the seed or its equivalent deposited and the farmer then rests from his labours in the happy supposition that Nature will do the rest.

At times everything goes well but more often partial or complete failure is encountered.

It is by no means sufficiently realised that the soil is one of our most valuable possessions and should consequently receive that proper attention and treatment to which it is entitled in order that the fullest benefits may be enjoyed therefrom; few would contemplate the neglect of a valuable horse for instance, yet poor and unsound cultivation is a matter of common observation.

It is highly probable that but a small percentage of the agriculturists of this colony fully understand or appreciate the why and wherefore of the tillage operations which they occasionally perform and it is for this reason that we have reproduced in this issue of the Journal the excellent article

on the conditions affecting soil fertility by Dr. Juritz of the South African Agricultural Department.* A careful perusal of this article which is quite simply worded and readily understandable will result in a sound knowledge of the principles underlying soil cultivation and the consequent necessity of correct and thorough tillage in the successful production of any crop.

* From the Agricultural Journal of the Union of South Africa, Vol. vii. No 1, January, 1914.

Model Rules for Pig Insurance Society.

The Board has issued a set of Model Rules for a rural co-operative Pig Insurance Society registered under the Friendly Societies Act, 1896, which they hope will prove useful not only to pig-owners contemplating the formation of such a society, but also to clubs which are already in existence.

The rules in question have been divided into two parts, the more important rules from the point of view of the ordinary member being contained in Part I., which deals principally with membership contributions, marking of pigs for insurance, inspection of diseased or injured pigs, valuation, benefits and liabilities of the society, liability of members, insurance fund and management fund. Part II. deals with such subjects as the general meetings, the committee and officers, the application and investment of funds, penalties and fines, and inspection and audit.

Similar model rules have also been issued for Pig Clubs which may not desire to register themselves under the Act.

Either set of rules may be obtained from Messrs. Wyman & Sons, Ltd., 29, Bream's Buildings, Fetter Lane, E.C., price ld.

Some Conditions which Affect Soil Fertility.*

By Charles F. Juritz, M.A., F.I.C., Government Analyst, Capetown.

INTRODUCTION.

Many people have very incorrect ideas as to what is meant by the "fertility" of a particular type of soil. One hears a certain soil spoken of as not being fertile, when what is really intended is that the soil is unproductive. There is a world of difference between fertility and productiveness. Fertility is a quality bound up in the soil itself; productiveness depends only in part on the soil's fertility, but largely on causes wholly external to the soil. True, no soil can be productive unless it is fertile, but every fertile soil is not necessarily productive. If a soil possesses within itself the capability of yielding the best results under proper treatment, such a soil is fertile; it is productive only in proportion as it receives that treatment. The most fertile soil cannot be productive if allowed to lie uncultivated or if it has been sown with bad seed, or if good seed be sown but either too early or too late, or if the weather has been unfavourable. In short, we might almost say, although it is only approximately true, that the responsibility for fertility rests with the soil, for productiveness with the farmer. It is the function of science to study the problem of soil fertility; it is the art of agriculture, sometimes under the most adverse circumstances, to turn fertility into productiveness. We should make a point of getting this distinction quite clear in our minds, so that we do not blame the soil for a supposed lack of fertility when the fault is no more than a failure in the productiveness due to our maltreatment of a soil that may perhaps be inherently as fertile as can be wished.

Now this paper is not going to deal with productiveness—that is the agriculturist's side of the subject. What I do wish to speak about is not the art but the science of soil cultivation, and the phase which is covered by the word "fertility." But, whether fertility or productiveness be the theme of discussion, those terms are always used as expressing a certain relation—the relation of the soil to the plant.

* The second part of this article will appear in the next issue of the Journal.

Now it must be plain that the fertility of a soil is just the expression of its adaptability to the requirements of the plant. When the soil conditions approach closely to those requirements such a soil is said to be fertile, and the nearer those requirments are approached the greater is the fertility of the soil.

If, then, high fertility in the soil means close correspondence with the need of the plant the question, "What are the soil conditions of fertility?" is dependant for its answer on the further question, "What are the exact wants of the plant?" Though in a lower scale of existence, plants are living organisms like ourselves, and, to a limited extent, our needs are also theirs—to a limited extent their vital functions resemble ours. We breathe, we drink, we eat; plants also must breathe, they too must drink, and they have to feed. Life has been defined as being in active correspondence with one's environment, and in so far as this is true, there must, if plants are to live in the soil, be that in the soil that can be respond to each of the three vital functions of plants that I have just named. From those three points of view let us discuss a few of the many problems which soil fertility presents.

RELATION OF THE SOIL TO THE BREATHING OE PLANTS.

Plants, we say, have to breathe; that is they need air, although they do not inhale oxygen from that air, and exhale carbonic acid as we do. With them the process is just the reverse; they inhale carbonic acid and exhale oxygen. But, in order that they may do this, they must be furnished with means of communication between their external system and the outside air. The surfaces of all plant leaves are so provided with thousands of breathing pores. But that is not enough; the roots of the plant as well as the leaves require to be in contact with the air, and this is where fertility conditions in the soil enter into the question. Clearly the roots cannot have this contact with the air which they want unless there are spaces in the soil into which the air can enter; that is to say, the soil must be porous, something like a sponge. Unless there is this air in the soil the plants that grow on it will not be healthy.

But the mere presence of air in the soil is not enough; it must be in a state of continuous circulation within the soil,

because the plants not only need air round their roots but they need fresh air, and every shower of rain and every irrigation flooding that thoroughly soaks the upper soil, when it drains away, draws down a new supply of air to fill the soil cavities vacated by the water. And so it is not sufficient that the soil has a number of disconnectd cavities filled with air, but there must be numerous tiny channels by which the entering air can pass from cavity to cavity. This circulation is needful mainly for two reasons; in the first place, as the air already in the soil gets used up in the process of plant growth fresh supplies must enter to take its place; and, moreover, substances deleterious to plants are constantly being formed within the soil and the circulation of fresh air in the soil is necessary to oxidize or destroy those harmful substances. A stagnant pool, as you know, becomes offensive, but running water and the turbulent ocean waves, by constantly shaking up their constituent impurities with fresh quantities of air, are able to keep ever sweet and pure.

What harm may be done to plant life by the presence of impure air in the soil we learn from the fact that in the streets of Washington hundreds, perhaps thousands, of trees have to be removed every year because they are killed by the leakages of coal gas from the underground gas mains. Professor Whitney tells us that the amount of gas that enters the soil from those mains is so small that it cannot even be smelt, but the quantity is nevertheless quite large enough to act so injuriously on the trees.

Another reason why the soil requires to be constantly aerated I now mention only in passing—it belongs to a phase of the subject of soil fertility to which we shall return by and by. Bacteria play a most important part in the soil in connection with the nourishment of plants. These bacteria would, in many cases, be unable to exist without a free suppy of air, and so, from this secondary point of view also, the aeration of the soil is inispensable for plant life.

In most climates it is particularly needful that the soil should be aerated, for otherwise the water in the soil may act as a hindrance to the adequate supply of air to the plant roots, and conditions may thus be produced similar to those just instanced. On the other hand, in arid regions too free a circulation air through the soil may do harm by parching the soil. Especially is this the case where hot and dry winds prevail.

From all this you see how important it is that the texture of the soil should be just such as to afford the plant the right amount of what I might conveniently call soil air. In most cultivated soils the pore-space—by which, of course, the portion of the pores or openings inside the soil that either do or can contain air—amounts to from 25 to 50 per cent. of the soil volume. In sandy soils this pore-space may amount to not more than 26 per cent. of the entire soil volume, and in coarse gravelly soil it may even fall as low as 10 per cent. On the other hand, in some alluvial soils it may rise to nearly 70 per cent. As a rule some of this space contains not air but water, but it is generally desirable that not such less than half thereof—or roughly 15 to 30 per cent. of the total volume of the soil—should in any case be reserved for the free circulation of air. Circulation naturally improves a soil's air capacity, and so Boussingault and Levy found the amount of air contained in well cultivated garden soil to range from 10,000 to 12,000 cubic feet per acre, while uncultivated forest soil contained from less than 4,000 to 6,000 cubic feet. Taking an acre-foot to be 43,560 cubic feet, these proportions would amount to 23 to 28 per cent. in the garden and 9 to 14 per cent. in the forest soil. The conditions of South Africa are so different from the world's older countries that questions like these ought to be investigated here with special reference to this country. The subject of soil-aeration has hitherto suffered from enforced neglect, but I may mention that when, shortly after Union was inaugurated, I attempted to begin an investigation of Free State soils, I found the pore-space or porosity of a virgin veld soil near Boemfontein to be 49 per cent., while in several orchard soils in the neighbourhood it ranged to 48 and 53 per cent.

RELATION OF THE SOIL TO THE DRINKING OF PLANTS.

I must pass on to speak of the function of the soil as adapted to the plants' need of water, for plants must drink as well as breathe, and their capacity for drinking is almost incredible. Let me detain you for a few minutes with some statistics. By far the greater part of most living plants consists of water. Water, to the extent of close on 90 per cent. is contained in root crops in their fresh condition. In the Kaffir water-melon repeated analyses in the Government Laboratory at Capetown have shown over 93 per cent. of water to be present. In the vijge bosje and vaal bos of the Karroo I have found more than 80 per cent., and in the ganna not very much less. But these

are only the amounts of water the plants take up from the soil to retain as part of themselves. This water, therefore, constitutes what I may call the permanent water of the plant. But plants also take up water seemingly for no other purpose but to pass it off again into the air, and this I may term their transitional water. The latter has, however, most important work to do within the plant in distributing its food to various parts thereof. The quantities of water which the plants take up in this way from the soil, but do not retain—those quantities which the plants pass off again as vapour into the air through their leaves—many times exceed the amount, large though that may be, which they retain permanently. I do not propose to deal with this passage of water through the plant at any length on this occasion, as that was done in the paper read by me before the 1910 Irrigation Congress. Let me, however, venture to place one or two typical facts before you. A farm in Malmesbury Division, during one season two or three years ago, produced barley, grain and straw together at the rate of 6,000 lbs. weight per morgen—I take this one case at random out of several in the cereal district of the Western Province. Even when dried by prolong exposure to air there was still 11½ per cent. of water in the grain. In its fresh state the barley crop had probably contained about two tons of water per morgen. Now, it has been found that total amount of moisture taken in by barley from the soil and afterwards exhaled into the air may amount to well over 700 times the weight of the dried plant. Under such circumstances there would have passed into the air that season, for every morgen of barley from that Malmesbury farm, somewhat over 2,000 tons of water And all this water has been provided for the crop by the soil. This means that if we take one morgen of dried soil one foot deep as weighing 4,000 tons, that soil would have been in a position to transfer water to the extent of 50 per cent. of its own dried weight to the growing barley crop from sowing time to harvest. Assuming the annual rainfall of the Malmesbury District to be 16 inches one morgen (approximately 90,000 square feet) would thus receive 120,000 cubic feet or somewhat or 3,600 tons, of rain-water (33 cubic feet of water = 1 ton). Such an annual rainfall would be ample for the needs of the barley crop.

But even in the Malmesbury District every year is not a year of average rainfall, and there are many districts which do not enjoy an annual rainfall averaging 16 inches, nor have

they the advantage of participating in the benefits of irrigation. Some of the districts alluded to, such as Van Rhynsdorp, on a study of some of whose soils I have been recenty engaged, are looking forward to benefit by irrigation in the near future. but at present the Van Rhynsdorp Division has to do the best it can on an average rainfall which would bestow on the soil 45,000 cubic feet, 1,350 tons, of water per morgen, not enough —when percolation and evaporation are allowed for to supply the needs of a crop that requires 2,000 tons of water per morgen.

Now, it is very important under circumstances such as these to understand what a soil's absorptive capacity and retaining power for water is—I mean, to know how much water a particular soil can take up and also how long it is able to hold this water. In the Bloemfontein orchards I found about 20 per cent. of water still in the soil about five months after irrigation had ceased. It may also be that the lower soil levels retain water in much larger proportion than the looser surface soil. On some of the Constantia farms we have found that when the water in the first foot of soil is about 10 per cent., and in the second foot somewhat less, the fourth foot down will still hold as much as 15 per cent. of water. In the earlier part of this paper I said that the soil is like a sponge, because of the openings which it has between its solid grains or particles. By irrigation you may fill up these openings completely with water or the rain may do so. This of course cuts off the supply of air from the roots of the plants. and if such a condition lasts too long—Hilgard says for longer than three weeks—the plant suffers in the manner of which I gave some instances a few minutes ago. The water which thus saturates the soil we speak of as "free water," because it is free to percolate or drain away unless prevented by an impervious stratum which holds it, as in a basin, much to the detriment of the crops above.

When the water that is free to drain away is gone there is always some water left in the soil, kept there by the capillary attraction of the fine network of channels between the soil particles. This water we call "capillary water" and it is on the capillary water mainly that plant life is sustained during longer or shorter periods of dry weather The free water in a soil you will therefore see is of the nature of surplus—its continued presence would do harm, and so it is allowed to drain off. Capillary water on the other hand, just suits the plants requirements, so it does not drain away nor is it given up by the

soil—except by evaporation from the surface—otherwise than to the roots of the plants. But now I come to another distinction. Both free and capillary water move about in the soil, but there is a third form in which water exists in the soil, and that is as hygroscopic or film water. In this form the water can no longer drain away like free water, nor be drawn from place to place like capillary water, for it adheres very firmly, although as a mere film round each of the soil grains. The presence of free water in the soil means a condition in which there is too much water for plants; where there is no more than capillary water there is just the right amount; when there is only film water there is too little, and plant life can no longer be sustained on such soil—not even by dry farming.

Let me give you a few illustrations to explain the proportions of these different forms of water that soil smay contain. In respect of five soils near Bloemfontein I determined the the quantities of water that each could hold when filled up to saturation point, that is if it contained not only film and capiliary water but also its utmost limit of free water. In each case I calculated the quantites of water in the various forms that 100 lb of absolutely dry soil could take up and so I found that one soil 100 lbs. in a perfectly dry condition could take up 4.5 lb. of film water, then additional to that, 37.2 lb. of capillary water, making, together with the film water, 41.7 lb., and over and above these soil still had a capacity to take 4.9 lb. of free water before it was entirely saturated, thus bringing up its total water capacity to 46.6 lb. But the soil, as it lay in the orchard, has actually only taken up only 24.0 lb of water per 100 lb. of dry soil, *i e.*, the full 4.5 of film water and 19.5 out of the possible 37.2 of the capillary water. The above figures and similar results for four other Bloemfontein soils are tabulated below, all the figures being calculated with respect to 100 lb. of perfectly dry soil :—

	Capacity of Film Water.	Water actually found.	Capacity for Film and Capillary water together.	Total water Capacity: Film, Capillary and Free.	Weight of Air-dry Soil per Cubic Foot
	lb.	lb.	lb.	lb.	lb.
A	4.5	24.0	41.7	46.6	77
B	4 7	17.2	45.1	51.6	73
C	3.1	15.1	36.9	42.7	80
D	2 9	6.2	35.0	41.4	82
E	2.7	12.1	34.0	39.6	84

I may say that all these soils except D were orchard soils, D having been taken from the virgin veld. I have added in each case the weight of a cubic foot of air dried soil for the purpose of showing that one-tenth of that weight, added to the capacity of the dried soil for film water, sums to the identical figure approximately (11.1) in each of the last three soils, and to a figure approximately thereto in the others (12.2 for A and 12.0 for B).

Sweet Cane from a Far Country.

It has been supposed that sugar cane was the "sweet cane from a far country," mentioned in Jeremiah vi. 20, and in Isaiah viii. 24, according to Strabo, Nearchus, admiral of Alexander the Great, describes a kind of "honey" from an Indian "reed" which was probably sugar cane. Europe seems to be indebted for the plant to the Saracens, who introduced it into Rhodes, Cyprus, Sicily, Crete and Spain in the ninth century. The crusaders of the twelfth century found it in Syria. The Spaniards and Portuguese carried it to Madeira and the Canaries in the fifteenth century and on the discovery of America, it was taken to the West Indies.

—"Biloxi Herald."

The Grass Moth.

REMIGIA REPANDA.

A PEST OF SUGAR CANE, RICE AND PARAGRASS IN BRITISH GUIANA.

By G. E. Bodkin, B.A. Dip Agric. (Cantab.), F.E.S., F.Z.S. Government Economic Biologist.

CLASSIFICATION AND HISTORY.

This insect is a member of the well-known family Noctuidae of the Lepidoptera Heterocera and was recorded by Fabricius in 1792 Since that time it has received attention from several authors* and the various phases of its life history have been described. Owing to its habit of living on numerous grasses and particularly para-grass it has been decided to give it the 'popular' name of the Grass Moth. In British Guiana it has been a well-known pest for many years though this is the first account of its life history, habits, etc., that has been published here.

DISTRIBUTION.

On sugar cane, rice, para and other grasses throughout the coastlands of the colony this moth may be found throughout the year and at certain periods, particularly on the occurrence of rain after prolonged drought, it appears in vast hordes completely destroying whole areas of the previously mentioned crops. It also occurs in several of the interior districts.

In Trinidad it has recently occurred as a serious pest and it is also known as a pest in Jamaica. These are the only records available of its appearance as a pest in the West Indies and elsewhere.

The Biologia Centrali Americana gives the following localities whence Remigia Repanda has been recorded.

1.* *Ent. Syst. Fabricius iii. 133. 1793.*

2. *Guenee 1852. Spec. Gen. Noct. Vol. iii p. 325 description of larva.*

3. *Gundlach, 1886. Entom. Cubana. p. 384, description of larva and pupa.*

4. *Dyar. Proc. of U. S. Nat. Museum Vol. xxiii· p. 276.*

Canada, Labrador, United States, Texas, Florida, Mexico, Honduras, Costa Rica, Panama, Colombia, Venezuela, Guiana, Amazons, Brazil, Argentine, Antilles (Cuba, San Domingo, Jamaica and Martinique).

ECONOMIC IMPORTANCE AND METHODS OF ATTACKS.

Under normal circumstances this insect is not responsible for any serious damage and may be easily controlled.

With sugar cane whole fields of young canes (those from two–four months old) are at times completely stripped of their foliage nothing but the hard mid-rib being left. The larvae may often be found destroying rice plants in the nursery beds in conjunction wth the rice caterpillar (*Laphygma frugiperda. S and A*) and it also attacks the foliage of full grown plants. Whole fields of para-grass grown for fodder are at times completely defoliated, nothing but the stems being left. The prolonged drought which occurred here in 1912 was, on its cessation, and the advent of the rains, responsible for the sudden enormous increase of all classes of insect pests and *Remigia* appeared in countless swarms destroying every species of grass also seriously damaging sugar cane and rice. The remarkable spectacle was then witnessed of thousands of the larvae which had exhausted the supply of food in one area migrating to fresh areas thus forming a veritable army of caterpillars on the march. Devastation at this time was extraordinarily rapid, owners of fields of para-grass who some days previously had observed their fields making satisfactory growth, on their return discovered nothing but a field of defoliated stems.

With the exception of the sugar estates little was done to check these ravages, the characteristic attitude of *laissez faire* being assumed by farmers and small cultivators. Luckily however the second and third generations of the pest were controlled by parasites and a parasitic disease and in a few months a normal state of affairs was attained.

FOOD PLANTS.

Sugar cane, rice, Para grass (*Panicum muticum*) and a number of other commonly occurring grasses are the food plants of *Remigia repanda* in British Guiana. Gundlach in Cuba gives the food plant as *Hypericum* and Dyar in the United States gives various species of grasses.

LIFE HISTORY.

The various instars of the life history of this insect have been very fully described by Dr. Dyar* of the United States National Museum. On comparison with the notes made on the life history in this colony the two were found to coincide. Dr. Dyar's description is consequently appended at the end of this article.

The ova have been never observed on the food plant in this colony though ovipostions made by moths in confinment indicate that the eggs are laid more or less singly and not in large clusters as with the rice Caterpillar.

A complete life history, *i.e.*, from the deposition of the egg to the hatching of the adult moth from the chrysalis occupies under normal circumstances from 26–31 days as follows :—

Egg period.....from 3–4 days.
Larval period.....from 14–17 days.
Pupal Period.....from 9–10 days

The pupa is invariably found in a cell formed by the drawing together of several blades of grass into the form of a rough cocoon.

The larva is easily recognised by its habits of looping up its body when in movement and has thus received the Creole term of 'measrue worm.'

The moth itself is somewhat inconspicuous, grey brown in general colour with two dark transverse lines across the wings, running at an angle towards the anal extremity, the fore-wings bear a number of distinct cryptic markings.

Wing expanse.....1½ inches.
Body length.....¾ inch.

The moth is frequently seen during the day time as it is easily distributed from its resting-place ; it does not seem to be attracted to artificial light.

NATURAL ENEMIES.

No actual parasites have so far been secured from this insect in British Guiana though there is but little doubt of their existence.

*Proc. of U. S. Nat. Museum Vol. xxiii. p. 276.

The Coccinellid Beetle *Megilla maculata. de Geer.* frequently preys on the young larvae and the so-called Demerara Robin (*Leistes Guianensis*) will also feed on them.

A parasitic disease appeared in several districts during 1912.

CONTROL MEASURES.

On sugar estates the usual method employed when a slight attack of this pest is encountered is to pick them off the canes by hand and drop them into buckets containing kerosine and water.

As many as twelve bucket-fulls have thus been obtained by a few workers during the course of the day.

When plenty of labour is obtainable this undoubtedly is an effective measure but the application of dry powdered arsenate of lead would give just as satisfactory results and would prove cheaper.

When attacking rice in the nursery beds flooding may be resorted to as described for the control of the Rice Caterpillar,* it will be found a very effective method.

As regards Para-Grass the value of the crop hardly guarantees the application of control measures. A field when badly attacked may be left till the caterpillars enter the chrysalis stage and the field then burnt off to prevent further infestation.

DR. DYER'S DERCRIPTION OF THE LARVAL STAGES OF REMIGIA REPANDA.

Egg.—Spheroidal, very slightly flattened above and below, Symmetrical; about 24 low, sharp, vertical ribs, not diminishing in number till toward vertex, where all end, cross lines fine and obscure, those with the vertical reticulations invisible to the lens, but seen under ½ inch objectible. Diameter 0.7. m.m. Slightly greenish grey, not shining. Later a vertical dull red blotch and irregular lateral ring.

Stage I. Head bilobed, rounded, full, free from joint 2, clypens small; shining-testaceous, brown tinted; ocelli black; width 0.3. m.m. Body slender, thread like; feet on joints 9, 10 and 13, colourless transparent, food green; shields all

* Journal of the Board of Agriculture. Vol VI. No. 4. p 182.

concolorous and inconspicuous. Tubercles small round, black. A subdorsal (over tubercles 1 and 2), lateral (above 3) and stigmatal (tubercles IV), faintly brown lines, central segments, long drawn out, the tubercles remote. Thoracic segments and joints 9 to 13 normal not elongate. Cervical shield with 2 detached setae on the posterior corners, four on the shield ; greenish, concolorous. Head setae normal, clypeal and paraclypeal, ones small. Anal feet directed posteriorly, blackish outwardly, tubercles of joint (ii) very small, the segment therefore weak. Other tubercles normal, i and ii in line, IV behind spiracle ; on thorax i.a and i.b. approximate, ii.a. and ii.b. remote, IV anterior ; no subprimaries. Later the narrow brown lines are more distinct, covering joints 2-13 with a line on the anal foot.

Stage II. Head round bilobed, full, cheeks below squarish. clypeus reaching above middle of front, ; whitish, green-tinted, four vertical l rown stripes on each lobe ; the two next median sutures join above, diverge below, one to the jaw, the other to the antenna, this joins the third at antenna which then runs to back of head laterally. The fourth on lower edge of cheek behind ocelli, is double, the ends approximate, forming a pointed ellipse ; width O. 5. m.m. Body slender, uniform, a little flat ; abdominal feet on on joints 9, 10 and 13, the latter directed posteriorly. Three brown stripes on each side, reaching joints 2 and 13, the shields invisible and uncornified.

The lines are subdorsal (over tubercles 1 and 2), lateral and stigmatal (covering 3 and 4), with two fainter subventral lines on VI and VII, respectively situated below the subventral fold and ventrally opposed. Tubercles small, black well separated on the central segments, IV above the spiracle, nearly in line with 3, Setae dusky, feet pale.

Stage III. Head round, large, free from joint 2, slightly bilobed, clypeus rather small ; whitish, with 5 nearly parallel brown bands on each lobe, continuous with the lines on the body. They are a little irregular and lighter brown in the centre of each. Width O. 8 m.m. Body slender but uniform, little flattened ventrally ; abdominial feet on joints 9, 10 and 13. Pale greenish yellow, with dark brown lines about as wide as the intervening spaces. These are single, narrow, broken dorsal, double subdorsal, lateral, substigmatal, subventral, and pedal lines. The pairs are approximate, filled in between with yellowish brown, or might be called single lines

paler, centrally. The pedal line is only obscurely geminate. Tubercles and Setae black, the former minute Abdominal, feet pale, brown spotted, the anal pair lined. Thoracic feet reddish.

Stage IV. Head large for the body, round, full scarcely bilobed; white, with geminate, brown, pale—brown filled lines as before, the central white space over the sature the widest, Abdominal feet as before, lines the same; also a single medio-ventral line. A geminate, *i.e.*, double blackish dot in the subdorsal band in the incisure 5–6. The single dorsal line is nearly obsolete.

Stage V. Head rounded, full, very large, one and half times as wide as the body, projecting well above joint 2, smooth, not bilobed; pale yellowish, with many brown lines reaching from the mouth to occiput, parallel, curved, eleven on each side, obscurely in pairs; clypeus pale, as also the median suture somewhat broadly, and antennae; width 1.5 m.m. Body slender; no feet on joints 7 and 8: pale yellow, finely lined with brown; 3 lines and a broader median one below the subventral fold; fold yellowish, eight lines above it, namely, geminate dorsal, three subdorsal, united by a dark shade into a broad subdorsal band, double lateral, and double superstigmatal. The substigmatal pale interval is the subventral fold, and is yellower than the rest.

No shields nor plates; legs brown lined. Black dots in the incisure 5–6; tubercles absolute; setae rather large.

Stage VI. No change, the antennae are long, twice the length of the mouth. The head is large making the larvae club shaped, joint 2 widening to meet it, width 2.2 to 2.3 m.m lines very fine, brown, crinkly some breaking down, dorsal line fine, gemminate, subdorsal of 4 lines filled in with olivaceous shade, black dotted in the incisure 5 to 6; double lateral, single superstigmatal, single stigmatal, single substigmatal lines; head subventral of four lines filled in with brown like the subdorsal; dark brown medio-ventral with 3 lines it and the snbventral line, alternating reddish and brown. All on a pale yellow field, a little whitish in the dorsal space. Feet pale, brown spotted, Spiracles black ringed. Tubercles black, minute, setae rather long.

Stage VII. Head large subspherical, a little elongate, thick and free from joint 2, not bilobed; clypeus low, narrowly

triangular ; fifth ocellus close below antenna, large. Broadly white over clypeus and median suture, this colour a little more than covering the paraclypeal pieces and reaching the antennae, with a faint reddish line in the clypeus and another on the paraclypeal suture. Sides whitish, with many mottled brown lines extending upwards, parallel to each other, to the occiput, joining the lines on the body. There are about 18 on each lobe, each obscurely geminate, mottled with pale dots ; on the inner half of each lobe the lines are washed and connected with olivaceous. Clypeal and paraclypeal tubercles black, the others blackish ringed. Width 3 to 3.4. m.m. Body slender, uniform ; abdominal feet on joints 9, 10, and 13 ; smooth, nearly cylindrical. Yellowish white with many brown or black geminate, mottled lines. Dorsal line, red brown, double in or clear space of the ground colour subdorsal of 6 black lines with large black patch in the incisure of joints 5 and 6 ; 4 lateral reddish lines and nearly black superstigmatal pair ; a reddish stigmatal and substigmatal pair ; 6 irregular and broken line black, inclosed by a dark shade, forming a dark subventral band ; next a reddish, then blackish, then two reddish, and finally a broader, nearly black, medio-ventral band. No shields ; feet pale, marked with motted lines. Spiracles black rimmed. Tubercles and setae small, black ; tubercle IV of joint 5 a little above the middle of the spiracle, on joints 6 to 10 between the middle and lower corner, on joint eleven opposite the lower edge, on joint 12 likewise, but the spiracle is one line higher than on joint 11 when disturbed the larva curls up in a curious shape and is quiet, the black marks, ordinarily concealed in the incisure exposed. Cocoon an elliptical silky net in grass.

Food plants. Species of grass. Species seems to breed continuously.

L'Institut Colonial de Marseille.

This Institute has decided to establish a laboratory specially equipped for the study of rice and other similar cereal crops. This equipment will include machinery for testing different methods of preparing, milling, etc., and also the extraction of starch and alchohols. The chemical and botanical analyses of such crops will also be undertaken.

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The Cultivation of Vegetables.

By J. F. Waby, F.L.S., F.R.H.S.,

PART I.

The establishment of the model and school gardens of late years proves conclusively that vegetables are not difficult subjects to raise and we need only to peruse the reports of the various exhibitions held year after year to notice that good vegetables and salads can be and are produced in these gardens and even in the open competitions we come across good examples though these are much more rare than they should be. The general supply of good vegetables and salads in the market is far below what is needed and very much less than it should be, generally they are very poor indeed and therefore cannot demand a fair price ; they are carelessly grown, huddled together so that they have no room for expansion and have neither substance nor size.

To obtain good fresh seed is frequently a trouble ; presumably the demand is not sufficiently great or regular for those who import them for sale to keep small regular supplies so that they shall always be fresh, for these seeds cannot be depended on for more than a few weeks. Persons who wish to cultivate vegetables and salads as a permanent means of supplying their households should import their own seeds by post, small quantities at a time, sowing them on arrival. Some kinds—small salads—need to be sown each month or every few weeks, others 2–3–4 months according to their kind and orders should be arranged accordingly so as to avoid disappointment. There should be no attempt to save the seeds of imported vegetables, except perhaps a particularly good and well-grown kind which may give a fair return from the first seedling, but generally speaking they are most unsatisfactory and cause a deal of disappointment. As a rule imported vegetables—although they give a fair return, never give a crop too large for the supply of the household, besides, if the seeds are saved and sown the produce is always weakly and weedy.

A little advice is never out of place even in regard to common things which may have been grown regularly for years. Success is always better assured when there has been proper preparation, and it is to be feared that this has

frequently been lacking. It used to be said that it was only necessary to tickle the soil, to get a crop to grow, but for it to be remunerative it has been abundantly proved to need more than this. It has been sufficiently proved by the Farmers Competitions that something more than digging a hole and putting some plant into it is needed to get any compensation for even that little bit of work. The farmer has now learnt that the whole bed must be dug and deeply too, to ensure success, that drains must be kept clean and beds shaped so as to get off superabundant water, and that even if the season should be dry the crops do far better when the beds are constantly forked, so that air may penetrate and moisture be ow allowed to ascend. In all vegetable growing whether on the farm or in the garden there must be intense cultivation, the beds whether large or small must be dug deeply in the first instance,—too many people have been content to dig a fork deep, in fact it is the general thing done, not troubling about the depth immediately below, and when a heavy wet season has set in everything has succumbed to the rain, and why? because the digging a fork deep has left the subsoil intact and it has acted as the bottom of a shallow cistern through which the surplus water could not penetrate.

A piece of ground taken over for a vegetable garden must be dug deeply, *i.e.*, trenched; if the bottom depth of soil is good let it come to the top or mix it with the top soil; if poor, turn it over separately and break up the bottom beneath it; this secures the percolation of water in wet weather and in dry weather helps the moisture from below to ascend, besides admitting air to a good depth. This first digging should be done roughly, *i.e.*, left in fairly large pieces for the sun and air to act upon it for a time, it will then pulverize much more easily at the second digging than when first dug. The preparation for the actual planting should depend on the kind of plant or seed to be put in. For small growing plants or fine seeds the soil must be made fine so that there may be no interstices between the soil and the plants or seeds. For strong growing ones the soil need not be made so fine except at the points off contact, thus saving time and labour which can be supplied later on in the tillage which must necessarily follow.

Watering.—It does not seem to be generally understood that watering must follow immediately after sowing or planting, especially the latter, whether the weather be wet or fine. It

does not follow that because the weather is wet that a shower is going to oblige the planter as soon as his planting is done, his duty is to supply water at once so that the fine soil shall settle around the roots of the young plants as soon as planted. It has frequently occurred that planting has been done and the plants left for some considerable time without water, with the result that many of the young plants have withered up and become useless. For seeds it is not quite so urgent, provided they have no chance of becoming scorched which will occur if left lying in the blazing sun. It is always safest to supply moisture as soon as possible, because seeds cannot germinate without moisture. After, vegetables are generally thirsty subjects and must be supplied liberally with water morning and evening, yet this must be done with discretion as in the case of other plants, some need more than others and this can be learnt only by daily attention and observation.

Manuring.—No vegetable garden can be run without a plentiful supply of manure and this must be well decayed; fresh manure must not be used for this purpose—unless of course it is intended to let the bed stand empty for a week or two, not a very likely thing—but it is objectionable in the matter of introducing grass and weeds of which there is always an abundant supply. In manuring beds, place a liberal quantity on the tops and have it dug in with a fork, turning the soil two or three times to ensure it being well mixed. If holes are dug for certain plants and the remainder of the bed left for subsequent treatment as it becomes necessary, mix the manure with the soil outside the hole and then fill in; it is a common practice to fill a quantity of manure in the bottom of the hole and plant on the tops of it, needless to say this is waste and likely to prove injurious rather than a benefit to the plant, because when the roots reach a patch of crude manure they will probably find it too rank and failure will result. Strong growing plants need help after having made a certain amount of growth, frequently they use up all the nourishment provided when first planted and unless a further supply is given the last results cannot be obtained: these should have a good mulching of partly decayed manure—not fresh—so that in the watering nourishment can be washed down to the roots and in a week or so the manure can be dug in; if well decayed manure can be readily obtained, by all means use this and dig in at once. A good mulching of partly decayed manure will often prolong the life of vegetables which show signs of fading but are too good to destroy.

A Disease Affecting the Sisal Hemp Plant *Colletotrichum Agaves. Cav.*

By C. K. Bancroft, M.A. (Cantab). F.L.S. Asssist. Director of Science and Agriculture, and Government Botanist.

During the past five years a disease has affected the cultivated plants of sisal hemp in this colony. The available records show that it first made its appearance in the year 1908 and has since this first record assumed proportions which render it a factor of some importance in the cultivation of the plant.

Occurrence in the colony—As far as is at present known, it has appeared only on plants cultivated away from the coastlands, where the plants have been grown in some quantity. Near the coast lands it has not made its appearance ; but the plant has not been cultivated on these lands in any great quantity. Intensive cultivation may, perhaps account for the presence of the disease—a factor which is well recognised to favour the development and spread of plant diseases induced by lower organisms. As to the origin of the disease in this colony there is little doubt that the causative organism was present previous to the appearance of the disease in 1908, inasmuch as its appearance was on plants which had been grown locally and supplied from the Botanic Gardens, where the disease is not present.

Diagnosis.—The symptoms of the disease may briefly be put as follows :—

The disease affects the leaves of the plant It appears on the older leaves first. A yellowing of the leaves in patches is frequently an initial symptom ; this may be followed by small sunken patches usually occurring at points on the leaves and gradually extending. The disease may frequently commence at the tip just below the apical spine and it is not uncommon to see leaves withered to a distance of a half or one inch from the tip in the initial stages of the disease. Following on these initial symptoms the disease usually affects the greater portion of the leaf, which becomes withered, and spreads from the older to the younger leaves, the whole plant becoming gradually involved. It commences usually on single plants and spreads from these to the neighbouring plants, so that the cultivation becomes affected in patches.

Leaves which become withered are rendered useless for the preparation of the fibre.

Identification.—Field examinations of the affected plants disclosed symptoms similar to those occurring in a disease which has been known to affect sisal hemp and cultivated agaves in several parts of the world. Its first available record is in the "Sixteenth Annual Report of the Missouri Botanic Gardens." It was referred to by the writer in a "Handbook of the fungus Diseases of the West Indian Plants, 1910" as occurring in Antigua; and it was described by Massee in "Diseases of Cultivated Plants and Trees" of the same year. A similar effect has been recorded in German East Africa; and more recently Shaw has conducted work on the disease in India, Agricultural Journalof India, January, 1913. The disease was early attributed to a parasitic fungus Colletotrichum Agaves. Cav., although later it was attributed to excessive isolation of the plant such as occurs at mid-day in the tropics. The recent work of Shaw shows it to be due to the above-named fungus. Material collected and examined in this laboratory has demonstrated that a fungus of this genus is repeatedly associated with the disease, and it has been possible to cultivate the fungus artificially and to identify it as Colletotrichum Agaves.

The propagation of the organism is affected by minute spores which appear on the affected leaves in masses Acervuli) usually concentrically arranged and of a pink colour. Inoculations conducted artificially in this laboratory at the cut surfaces of the leaves have confirmed the work of Shaw of India with respect to the reproduction of the disease and of the organism of the diseased parts; and attempts to reproduce the disease by placing the fungus on uninjured surfaces of the leaves have failed, thus again confirming his conclusions that the organism is a wound parasite, *i.e.*, can only affect the leaf originally at a broken surface. Such surfaces are frequently presented in sisal plants and more especially at the tip of the leaves, where the disease so frequently commences.

For checking the disease Massee considers the only practicable means is the cutting off of the leaves on the immediate appearance of the disease. Spraying with a suitable fungicide, such as Bordeaux Mixture, is also recommended in India.

The disease appears to be of sufficient importance to warrant careful supervision in the manner of field direction to avoid its affecting serious loss to the cultivation of the plant.

The "New Disease" or "Dry Disease" of the Sugar Cane.

By C. K. Bancroft, M.A. (Cantab.) F.L.S., Assist. Director of Science and Agriculture, and Government Botanist.

History of the Disease.

The first record of this disease appears to have been made in Berbice in 1907. It has subsequently been reported to occur on many estates situated in different parts of the colony. On some of these a marked increase in magnitude of the disease has occurred since its first record ; on others the disease does not appear to have progressed rapidly ; while in some few cases the disease is reported to have been present at some time previously and later to have disappeared.

The symptoms of this disease are briefly as follow :—

As far as is known it usually appears in isolated stools or in a clump of stools scattered over a field. It is frequently particularly noticeable in the outskirts of a field, though it is by no means confined to these parts.

It appears in the form of a withering of the outer green leaves which commences at the edges and proceeds towards the mid-rib. The central leaves are not affected. The top of the cane dries and the cane dies.

Frequently an effort is made by the cane to produce new shoots, several " eyes " below the top sprouting ; this effect in fact frequently characterises the disease

The cane if cut open is found to be discoloured red. The red discolouration may appear in streaks or in thin lines.

The leaf-sheaths do not fall away readily from attacked canes, but tend to remain attached.

The old dry leaf bases are frequently matted together by a growth of white threads.

Many of the roots present a red or brownish colour and are dead.

A growth of white threads is present in the soil at the base of the cane and is attached to the roots. These may be present in small quantity and may sometimes escape csaual observation.

An examination of the disease was commenced in June last in affected fields, and material has since been subjected to examination both in the field and laboratory.

The mycelium of a fungus was found to be constantly associated with the disease, occurring in the soil in the form of white threads which were frequently attached to the surface of the diseased or dead roots. It is found that on planting the stools in damp earth the mycelium was produced in quantity.

The presence of what are known as " clamp connexions " on the mycelium, observable on microscopie examination to be present in small number, enabled the fungus to be placed among the higher fungi of which the toadstools are members. The mycelium was found to be stellately crystalline.

A microscopic examination of the diseased root and base of the stem showed the presence of hyphae of a fungus in the vessels. Some preparations showed these hyphae also to possess "clamp connexions." The presence of a stellately crystalline mycelium suggested that the fungus might possible be *Marasmius Sacchari* since the symptoms of the diseased were similar to those produced by this fungus.

A collection have been made of the higher fungi which occurred on the diseased and dead canes by Agricultural Assistant Hunte and myself. Four species were found to be associated with the diseased and dead plants. Of these two were recognised as saphropytic and harmless, viz., *Schizophyllum commune* and *Phallus aurantiacus*. Of the two remaining species one agreed well with the descriptions and figures of *Marasmius Sacchari* and also with my recollections of the fungus which I had seen several years previously. This and the other species were sent to Kew for identification where they were identified as *Marasmius Sacchari* and *Collybia ambusta*; the latter is not known as a parasite.

Diagnosis of the Disease.

The fructifications of *Marasmius Sacchari* were found both at the base of affected stools and attached to diseased

roots. The symptoms of the diseased plants differ in no respect from those which are associated with the root disease caused by this fungus. The mycelium of a basidiomycetous fungus has been found to be repeatedly associated with the roots of diseased canes; further this mycelium is stellately crystalline, as is the case with that of *Marasmius Sacchari*. From these observations it is concluded that the disease is due to *Marasmius Sacchari*

This fungus was first described as a parasite of sugar cane in Java in 1895. In 1899 the disease was recorded in the West Indies, and in Hawaii in 1905. The disease is propagated in three ways:—1. The germination and growth of the spores produced by the small toad-stools; 2. By the mycelium or white strands of the fungus which traverse the soil underground; and 3. By the planting of diseased cuttings or cane plants." The fructifications (toad-stools) are only developed at certain periods and are frequently only present in small quantities; they probably play a subsidiary part in the spread of the disease. The white strands of the fungus are able to live on dead material, such as litter, old cane stumps, etc., in the soil. They spread through the soil from root to root and from one stool to another. Their action is to destroy the roots of the plant with the resultant production of symptoms of disease in the parts visible above ground, first in the form of a deficient water-supply to these parts.

The methods which have been employed in combating disease have so far been found to be successful where they have been properly carried out. They may be detailed under four heads:—

1. *Improved Cultivation Methods.—a.* It is generally supposed that the fungus is weakly parasitic, and vigorously growing canes are less liable to attack than those which are weak. Careful methods of cultivation and drainage would tend to diminish the attacks from the fungus.

b. Ratoons are more badly attacked than plant canes. Special attention to the treatment of ratoon canes and the abandonment of ratooning in badly affected fields may be practised.

c. The throwing of badly infected fields out of cultivation and flooding of the land for a couple of years is a method which

may give good results, the object being to diminish the amount of the fungus by robbing it of its food supply.

2. *Isolation.*—The appearance of the fungus in isolated stools or clumps of stools along with its spread by the growth of the mycelium underground naturally offers a means of checking its spread by isolation by trenches. These may be made 24 inches deep and 12 inches wide and should enclose the infected area.

3. *Sanitation.*—*a.* The destruction of diseased stools is essential for the control of the disease. Affected stumps should be dug up and burnt. Trash from infected areas should be burnt. Lime applied, as nearly unslaked as possible and at the rate of 1½ tons per acre, to these infected areas before supplying would be beneficial as a fungicide.

b. The selection of plants for cuttings from infected fields should where possible be avoided.

The propagation of the plant by the practice known as "stumping" would tend to spread the disease unless special care is taken to avoid the use of stumps from infected fields.

4. *Disease-resisting Varieties.*—There are some canes which show a marked resistance to the disease, although it is doubtful as to whether any cane is immune. The varieties which are generally badly affected in this colony are Bourdon, D625, B208, and Green Transparent. The two former suffer more than any two varieties. Of the others D109 is frequently affected. D145 and D118 are more resistant. D216 and D159 are not reported to be affected. The planting of the more resistant varieties in badly affected fields for a period of several years for the purpose of checking the spread of the disease is a matter which should receive careful consideration. Supplying infected stools with plants of more resistant varieties should also receive attention. The object of these methods would be to reduce the fungus quantity in the soil to a minimum before replanting with the more susceptible varieties.

One more point in connexion with the disease which is worthy of mention is the relation of the disease to the attacks of the "borer." There is little doubt that plants affected by the "borer" would be more susceptible to attack from the fungus than healthy plants; but it is erroneous to suppose that

the disease is due to "borer" attack. The majority of the stools which have been examined show no sign of "borer attack."

The disease was previously investigated by the late Government Botanist, Mr. F. A. Stockdale, whose reports show that the white mycelium of a hymenomycetous fungus was present in some of the stools. The presence of light-purplish strands* were also recorded. No organism was, however, discovered to be present in sufficient quantity to account for the trouble. Fungal hyphae of two kinds were observed in the tissues of the roots, but it was not possible to say whether they were responsible for the diseased condition of the roots.

*These belong to the species *Phallus aurantiacus* mentioned above.

A New Method of Preserving Milk.

To the already known methods of prsserving milk another has been added by two Italian Physicans Their method is to preserve milk by means of an atmosphere of carbonic acid gas, under pressure. The milk remains unaltered for several days, both in its physical and chemical characters, and in the biological constituents, the ferments. Some of the germs present are killed, while others have their development arrested. By this method, uncooked milk can be kept for eight or twelve days at a temperature of 12° to 14° C., while boiled milk is preserved indefinitely. The gas is produced with little or no trouble. The inventors claim for this method a solution of the question of infant feeding. Milk preserved in this manner ought certainly to be superior to milk sterilized by heat, owing to the fact that milk can be kept by this process for a considerable period with all pathogenic germs absent, while its biochemical functions remain intact, which is not the case where heat sterilisation is used.

—The Tropical Agriculturist Journal, 1914.

Birds and Agriculture.

By Charles B. Dawson, S.J., M.A., Oxon.

I.

The economic position in nature occupied by our feathered tribes can hardly be over-stated. Long known to men of science, it is at last being tardily recognised by the small agriculturalist. But the man in the street knows nothing of it, and doubtless those who ply the trade of bird-catcher regard the Bird Protection Ordinance as a vexatious concession to sentiment.

Birds would deserve to be protected from artistic and sentimental motives alone; but there are other reasons and motives far more vital which make their conservation an absolute necessity in every country. What these reasons and motives are it is now my business to make clear. It is not too much to say that as all animal life on this planet ultimately depends for its maintenance upon the vegetable world, so also the vegetable world depends for its very existence upon bird life. Were there no birds vast hordes of insects would eventually eat up and destroy every vistage of vegetation.

There are in nature three tremendous life factors, mutually auxiliary up to a certain point and mutually destructive beyond it. These three life factors or forces are: vegetative life, insect life, and bird life. I am leaving out of my purview other life forces with which in this article we are not immediately concerned.

Vegetation, speaking generally, requires the services of insects for the propagation of its species. It requires insects as the carriers of its fertilizing pollen, and assiduously do these honey-seekers, whether they will or not, and all unknown to themselves, carry the golden germs of propagative life from flower to flower and from tree to tree.

Birds also, we may say in passing, are serviceable to plants and trees in carrying their seeds to distant places. Insects are necessary, within certain limits, to vegetation but they propagate themselves at a rate so truly prodigious that they require to be continually kept in check. Nature has provided

this salutary check in the feathered races, and thus she preserves her just equipoise. The number and variety of insects passes comprehension. Though they all fall under one class of the *phylum Arthropoda*, they comprise more species than all other species and varieties of the animal world combined. About a quarter of a million species are now known to science and it is surmised that almost as many more remain to be discovered. Twenty thousand species are classified in our local museum although vast regions of the colony are still entomologically unexplored.

The fecundity of the insect is truly amazing. Equally amazing is their voracious appetite. All their acts and energies would seem to be directed to these two great ends: to eat, and to reproduce their kind. A queen bee, for example will, lay upwards of a million eggs in her brief life-time; a termite queen, about eighty thousand a day!

It is computed that these latter creatures alone would soon denude the world of forests were they left unmolested. Similarly the grub of a single species of beetle would soon strip the earth's open spaces of her mantle of grass. Then as I have said they are enormous feeders Caterpillars will devour several times their own weight of vegetable matter in a day. It were truly a cruel fate if Nature required each of us to eat a whole sheep a day in order to sustain life. But nature works wisely and well.

Again, the tireless activity of insects is in proportion to their feeding. While it is estimated that a horse, for example, exerts a muscular force of 0.7 to its own weight, an insect exerts a similarly muscular force of from 14 to 23. It is not difficult to give concrete examples: a flea leaping several hundred times its own height, an ant carrying or dragging ten times its own weight and for long distances, a beetle with its powerful mandibles cutting through a growing tree-stock

It is well that Nature, which has endowed these pigmy though myriad batallions with such giant powers, brings forth at the same time their feathered foes to meet them. And she has so well balanced their respective energies that while the latter are unable to exterminate the former, they effectually keep their numbers within bounds, and thus preserve a necessary equipoise. We may compare these antagonistic forces to the incisor teeth of a rodent: sharp and serviceable so long as

they are equal and opposed; but disastrous to the possessor should one of the incisors become dislodged and its opposite tooth be allowed to grow unchecked.

So when the equipoise of Nature is disturbed ever so little disaster is sure to follow and thus we may have a plague of locusts, or ants, or mice, leaving desolation in their train. Man has sometimes attempted to adjust what he has considered an inequality in nature's balance by the introduction of the fauna of another country. Such attempts have generally proved conspicuous failures; witness the rabbit nuisance of New Zealand and the pest of the common-house sparrowin Australia. We may judiciously destroy our insects pests; but it is always dangerous to introduce new fauna into any country for we never know what developments may take place in a strange environment until we have let lose a force we can no longer control. We have ourselves had a slight experience of this mistake in the introduction of the mongoose into this country.

But there are certain insects that would seem to be pests and nothing else: insects that, as far as our limited knowledge goes, do no good to any tree are shrub and which no birds will eat or beasts devour. It is as if Nature, which keeps both birds and beasts active and verile by compelling them to seek for, or hunt their food, often under great difficulties, would have man exercise his highest gifts, and compel him likewise to be industrious by bringing into being these obnoxious creatures. She will yield to him the genial fruit of the soil only as a reward for patient labour and continual thought. He must diligently find out which, among birds and insects, are his allies, and which his foes.

I venture to state, under correction, that in this colony, all the various species of birds will prove, to some extent at least, his allies and all therefore should be protected by law. They deserve to be protected, in my opinion, not only on account of their economic value but also because of the pleasure their presence affords to all lovers of Nature.

Trees give necessary shelter to insects as well as to their inveterate enemies, the birds. And well do the latter repay their hosts, for without them, as I have already said, their existence would be threatened. Termites alone, as we have seen, would sufficiently account for the extermination of

all forest trees ; but nature has made these purblind creatures the food of many birds and mamals.

Birds in our gardens and orchards may eat much fruit and seed, but they well repay the toll they take ; for there are few birds which do not vary their diet with insects even when they do not feed exclusively upon them. With the exception of parrots, perhaps, all birds feed their young on insects to some extent, even when they lare themselves exclusive seed-eaters.

Birds are, as a rule, great feeders ; their digestion is rapid and they are full of activity being always on the move, and nearly always on the look-out for food. And this is particularly the case when they are rearing their offspring. In this colony some birds have several nesting seasons during the year. Young birds have simply enormous appetites as those can testify who, like the writer, have reared many nestlings by hand.

Two years ago, being in the country, I had two nests, one of Kiskadees and one of Grey Tyrant Birds, removed from a tree close by, and placed in my gallery for the purpose of personal observation, aware that their parents would continue to feed them. From earliest dawn till the last shades of the evening fell they plied their gaping mouths with food : berries of the manicole palm, moths, grubs, grasshoppers, beetles, small lizards and crabs, and even a young mouse, passed into their insatiable maws. Nor did they decline to receive morsels from my own unstinted hand. Several hundreds of insects must have been destroyed each day by these four parent birds.

It must be borne in mind that in ordinary conflicts, the opposing belligerents know nothing of each others' tactics except what they can discover by their art and craft ; but in this triangular conflict of nature the same mind governs all, and is equally sympathetic. So that while Nature gives to insects a thousand instincts and artifices whereby they protect themselves from their relentless foes, the birds ; she gives to the birds also corresponding arts and instincts in order that they may keep the numbers of insects down, without however exterminating them, and thus she preserves her just equipoise.

Nor must we consider that Nature in thus acting is a cruel stepmother. We are continually ascribing to birds and insects feelings and sentiments appropriate only to human beings.

For instance: a kiskadee captures a fine, fat, green grasshopper and batters it to bits before devouring it. The total amount of pain endured by this struggling victim would probably not be so much as we should suffer through pricking a finger. For larger game, such as lizards and birds, Nature has her own anæsthetics. A bird seized by a hawk and devoured, feels little if any pain at all, being for the moment paralized by what, for a better term, we must call fear. Everyone knows the story of Livingstone and the lion.

II.

I have stated, under correction, that all the birds of our Colony are the allies of the agriculturalist. I will now modify that statement and say that certain birds are absolutely necessary, other at least useful ; but none, harmful. And I cannot do better in support of my brief than bring the various orders of birds in review and shew how in each case their usefulness and importance may be vindicated.

We will begin with the Harpy Eagle, the King of Birds in this colony, and the most powerful of all his masterful tribe. He is not only an exceedingly handsome bird, the charm of any landscape, but extremely useful : for though he occasionally feeds on fawn, he does good service in keeping down such creatures (well in the mean but a nuisance in excess) as sloths, peccaries and monkeys.

Hawks and Falcons exercise a salutary influence upon all other birds, keeping them virile and alert. Moreover sickly and diseased birds fall an easy prey and thus the stock is kept healthy and epidemics are unknown. Merlins perform the same useful service in the savannah which hawks and falcons do so effectually amid trees and forests. The smaller hawks will not disdain a diet of frogs and toads, and even insects. Kites are chiefly scavangers, picking up dead birds and such like morsels which if left alone would feed and harbour multitudes of insects. Vultures everywhere do the same work but on a large scale. Buzzards being slow and heavy are less able to catch small birds, but content themselves with such small fry as beetles, grubs and snails ; and one species (*Rostrhamus socialis*) has been provided by Nature with a slender maxilla for hooking water-snails out of their shells and thus preventing them from multiplying inordinately.

Nature is thorough in her operations and so when at night hawks and other birds have retired to rest, she brings out of their lurking places, the owls and the night-jars.

Parrots, Macaws, Love-birds and the like (which according to some ornithologists are nearly related to owls) though they are not immediately necessary to the agriculturalist, so far as we know, are certainly not his foes for the wild forests are their feeding grounds. They may occasionally make depredations on his orchards but may easily be driven off. Their presence is an ornament to any landscape and their use in nature would seem to be that of retarding the too rapid growth and increase of forests by feeding enormously on their nuts and fruits.

Toucans, though they are chiefly fruit-eaters, will devour grubs and lizards with avidity. They are never found in such numbers as to be a menace to fruit-growers, and probably the grubs they devour, particularly during nesting time, fully compensates for the fruit they may purloin from the orchard.

Cuckoos, of which there are some dozen or more species in the colony, are very particular friends and allies of farmers, for their food mainly consists of caterpillars and grubs. And among cuckoos the " old witch " as it is called (*Crotophaga ani*) deserves special mention. This bird will eat almost anything in the shape of a grub, including hairy caterpillars eschewed by all other birds. It may be seen assiduously at work among the thick bushes. It will follow cattle, climbing up cows' tails and perching on their backs in search of ticks of which it seems particularly fond.

Woodpeckers and woodhewers are as useful as they are common, for they feed wholly on insects and their larvae, whittling and hewing the wooden fortresses of the latter with their hard conical bills. They have zygodactyl feet, like parrots and cuckoos. so that they can mount with ease the vertical trunks of trees as they search the interstices of the bark for food. And Nature has given some of them spinny tail-feathers on which they may rest back, while they chisel out their prey. About forty species are to be found in the colony.

Equally important for the same reason, is that large family of birds called, on account of size, and the erroneous belief that they fed on ants, *Formicariidae* or Ant Thrushes. They

are one of the most characteristic of the neo-tropical regions and in this colony number forty or fifty species.

Characteristic also is the equally numerous family of Tyrant birds of which the Kiskadee is the notorious example. They have acquired their name from the masterly way in which many species of the order pursue their elusive victims, frequently catching them upon the wing. They seldom if ever eat fruit, though they vary their general diet with berries. They are welcome to them.

Jacamars, Trogons, Mot-mots and Barbets follow in the same category from the farmers' point of view, though the latter two families vary their diet with fruit.

Kingfishers feed on small fish, water-beetles, and crustaceans, which they catch with masterly skill. The colony may boast of six beautiful species. They are solitaries, and very shy.

Swallows, Swifts, Humming-birds and Sugar-birds are all insectivorous; and though their prey consists of such small things as mosquitoes and other kinds of flies, no one who has had a touch of malaria will doubt their immense importance as the high executioners of such pestiferous vermin. The last two families also take honey from the flowers. But we have in the colony wild honey enough to spare. Then again they earn what they eat and render also service to the fancier by fertilizing flowers.

The Chatterers or *Cotingidæ* are forest dwellers and belong exclusively to these neo-tropical regions. They include some of the most gorgeously coloured birds in the world, such as are the Fire-Bird, the Purple-throated Continga, etc., and some of the most remarkable as the Cock-of-the-Rock and the Campenero or Bell-birds, all of which are found in this colony though like all beautiful things are rare. They feed chiefly upon seeds and berries with occasional insects and grubs.

Manakins (their near allies according to some ornithologists) are also forest dwellers feeding upon fruit and insects. The nesting habits of these birds are not known; but probably they feed their nestlings on insects. Being forest-dwellers they do no man any harm and Nature abundantly supplies them with food.

Thrushes, Wrens, and Warblers need no brief. They are all insects destroyers, and though thrushes vary their diet with fruit and may even do a little damage to cultivation, they generally repay the tribute they exact. The abundance of wild fruit and berries makes the probability of their contracting pilfering habits very remote.

The Vireos or Greenlets, which some authorities place among the Shrikes, and other among the orioles (*Icteridae*) are small olive green birds that feed wholly on insects and may be classed among the best friends and allies the agriculturist possesses.

Mocking-Birds, Bunyas, Cassiques and the rest of the *Icteridæ*, including the Caduri, Rice Birds and Troupials, are omnivorous. A colony of Mocking-Birds might conceivably do a good deal of damage, say, to an orange plantation, for they will eat up this fruit as it hangs on the tree, leaving the skin almost entire; Rice Birds also, I understand, sometimes do much damage to paddy fields. On the whole, however, they fully make restitution by the innumerable insects they destroy.

Tanagers or Sackis are all fruit-eaters, but many species will add worms to their bill-of-fare; also molluscs and larvae. Some even search among fallen leaves for their toothsome victims. One branch of this large family, (of which forty or more species are found in this colony) include species that are exceedingly beautiful and it is rightly named Calliste ; and foremost among these beautiful birds is the Rainbow Tanager. Others, the Euphonia, have beautiful voices. They never appear in such numbers as to annoy agriculturalists. The Blue Sacki and Louis d'Or are favourites everywhere.

Finches are seed-eaters, but most of them feed their offspring on insects and for this reason alone should be protected as the farmers' allies. While nature so lavishly supplies them with the seeds of weeds and grasses agreeable to their taste, the farmer need hardly fear for his crops of rice and millet. Many of them sing sweetly.

Doves and Pigeons are Nature's gifts of food to men. In more cultivated areas there have been plagues of pigeons causing devastation to the farmers' crops. Such is not likely to be the case here for many years to come. They are undoubtedly of great use to the agriculturist in keeping down

superabundant wild vegetation. Ground doves are specially useful in keeping open spaces free from a luxuriant growth of weeds, the seeds of which form their staple food. Pigeons will also eat molluscs, ants and their cocoons, and insects with their larvae and thus do great service.

Partridges, Marudis, and Tinamous or Maams, are excellent eating: Currassows or Powis Birds are less esteemed. They feed on seeds, roots, bulbs, insects and their larvae. Were they to appear in large numbers, plantations of maize and crops of potatoes might suffer serious damage.

The Hoatzin or Canje Pheasant is a shy bird and confines its peregrinations to the mangroves and low bushes that grow on the marshy lands in the neighbourhoods of creeks. In this entanglement of mangroves, mocca-mocca, psidiums and other semi-aquatic trees and shrubs, on the leaves and fruits of which it subsists, this lazy bird remains secure. And though we cannot say that it is necessary or even useful to the agriculturalist, at least no bill of damages can be written up against it. It should be protected for other reasons as being, as some would have us suppose, the connecting link between lizards and birds, and therefore of the greatest interest to biologists.

Storks, Herons and Bitterns, including the Nigger-head, the Negro-Cop or Iabiru, White Egrets, Quaaks, Gauldings and Tiger-birds, live in Marshy places and feed on small fish, crabs, reptiles and insects. The wholesale destruction of the white Egret for "osprey plumes," has done incalculable harm in the rice-fields of India and China. These birds do not touch grain but render inestimable service to the planter or agriculturalist by destroying innumerable batrachians, crustaceans, and pestiferous insects of all kinds.

Ibises, including that most gorgeous bird the Curri-Curri, Spoonbills and Flamingoes, may be found at the mouths of certain rivers hunting at low tide for fish, molluscs, beetles, insect larvae, and crustaceans; also in marshes near the sea wherein frogs abound. They do great service, for if crustaceans were not kept within due limits there would be few fish in the rivers, for these creatures have ravenous appetites and include fish-spawn in their menu.

Snipes, Plovers. Curlews and Sandpipers perform the same necessary service but carry their operations farther inland,

They do not eat seed though they may occasionally eat vegetable matter.

Grebes confine their activities to rivers and their diet is much the same; they also eat small fish when they can catch them.

Rails, including Killicows, Crakes, and Moor-hens, have a special facility in moving quickly among dense underwood and are thus specially useful in keeping down worms, molluscs, insects and their larvae that frequent such places. They add seeds, roots and tubers to their long bill of fare. They are shy birds otherwise they might do damage to crops of rice and potatoes.

Trumpet birds feed on seeds and insects. They sometimes appear in flocks of hundreds and certainly might do considerable damage to plantations should Nature withdraw her bounteous hand in their own native haunts. Easily tamed, they become familiar and even affectionate and will keep guard over domestic fowls.

The Horned Screamer is the the ancestor of all Geese, according to some ornithologists. It inhabits lagoons, swamps and waste places and feeds on water-plants, seeds, etc. It is the size of a turkey and is so named from the slender horn-like caruncle that grows on its forehead and from its habit of uttering loud screaming noises as it soars in circles at a great height. It has spurs on its wings, and like the preceding, is often domesticated as a protection to poultry: an office it fulfils to perfection.

Spur-wing or Jacanas have their habitat in marshy wastes and are certalnly an adornment to such places. The abnormal length of their toes enables them to walk on the floating leaves of lilies. In habits they resemble moor-hens, and their food is similar; but they are very dissimilar in other respects and belong to a different order.

Ducks, like pigeons and game birds, are Nature's gifts of food to man. On the great savannahs, preferably near the sea, they may be found in incredible numbers: Muscovy, Vicissi and Teal. Though their chief food consists of water plants and grass-wrack, they devour enormous numbers of water larvae, molluscs, frogs and crustaceans and thus perform

invaluable service. They may incidentally do considerable damage to the nursery beds of rice plantations simply by choosing them as a temporary roosting place and thus crushing the growing shoots. But every good agriculturalist should be prepared for such contingencies, and take preventive measures.

The Ducklar, Darter, or Snake-bird, as it is variously named, is the cormorant of the rivers and feeds exclusively on fish which it catches with great skill under the water ; nor does he need to rise to the surface to swallow them. It, possibly, adds frogs and water insects to its bill of fare.

Cormorants, Gannets, Pelicans, and Frigate Birds are denizens of our sea coasts and feed on fish of which the sea has enough and to spare. They provide the agriculturalists with excellent guano.

Gulls are, to a great extent, the scavengers of the sea and the seashore, for besides fish, they will devour carrion and offal of all kinds. When the tide ebbs out, they may be seen doing their useful duty on the sand-banks and mud-heaps thus exposed. They will flock to newly-tilled land to forage for the grubs and slugs the plough has turned up and thus do splendid service·

The Skimmer, Cut-water, or Scissors-bill, is a gull that frequents the mouths of rivers. Its bill is like a pair of tailor's scissors with the broad blade below. As it skims along the water it lowers the end of this lower mandible into the water and thus scoops up small fish, crustaceans, and animalcula.

Terns or Sea-swallows are cleaner feeders than gulls and more elegant in form. They are the wind-hovers of the sea and maritime streams.

Petrels are archaic forms of ocean birds with great powers of flight. Their resemblance to gulls is chiefly external. They are distinguishd from all other birds by having tubular nostrils which are impervious to water. They seldom approach land except for nesting purposes. With this interesting bird we must close our brief review of the birds of this colony.

During the past fifty years science has made immense progress and many able men have studied the habits of birds and fauna generally. Yet, perhaps, we have as yet only touched the fringe of economic zoology.

Of the necessity of birds generally for the conservation of our vegetation we are experimentally sure.

Our brief review shews that the different orders of birds have not the same economic importance and that some may be required to be kept in check, as the civilization of the Colony advances.

Perhaps with the advancement of biological knowledge we shall discover that all the orders of birds are necessary in Nature's great scheme, though not all in the same degree.

White Ant Preventitives.

The following treatment has been suggested by Mr. C. J. Chadwick, of the Burma Para Rubber Co., Ltd., to prevent white ants damaging young coconut plantations.

Crude Perchloride of Mercury	...1lb.
Water	...10 gallons.

The soil surrounding the young palms is saturated with this solution.

—Tropical Agriculturist, February, 1914.

Kaniit (a potash manure) if well dug in about the roots of fruit trees will prevent the ingress of Termites.

New South Wales Journal.

Entomological Notes.

Parasite Determinations.

We have recently received through Dr. L. O. Howard of the Bureau of the Entomology, United States Department of Agriculture the determination of the black parasite which is frequently found in the eggs of the two species of small moth-borer (Diatraea saccharalis and D. canella). from the cane-fields of British Guiana. The determination was made by Mr. J. C. Crawford of the United States National Musuem. He names it *Prophanurus alecto. Cwfd.* (*N. sp.*)

The following determinations of parasites have also been received from the same source.

Arrhenophagus chionaspidis. Auriv. Bred from *Chionaspis citri. Comstock and Hemichionaspis minor. Mask.*

Leptomastix dactylopii. How. Bred from *Pseudoccus citri. Risso.*

Prophanurus thais. Cwfd. (*n. sp.*) Bred from the eggs of a *Pentatomid* Bug.

Holcencyrtus calypso. Cwfd. (*n. sp.*) Bred from the larva of *Calpodes ethlius. Cramer.*

Elachertus meridionalis. Cwfd. (*n. sp.*) Bred from Larva of *Calpodes ethlius. Cramer.*

Aphanurus bodkinii. Cwfd. (*n. sp.*) Bred from ova of *Empicoris variolosus.* L. (Pentatomidae).

Chalcis pandora. Cwfd. (*n. sp.*) Bred from the pupa of a Hesperid Butterfly on sugar cane.

Aplastomorpha pratti. Cwfd. Bred from *Lasioderma serricorne.* F.

Prophanurus. minutissimus. Ashmead. Bred from *the* ova of a *Noctuid* Moth.

Predaceous Coccinellidae.

We have recently received through the Imperial Bureau of Entomology the determination of several Coccinellidae which play an exceedingly useful part in the destruction of harmful Coccidae, They are,—

Azya pontibrianti. Muls.

Hyperaspis trilineata. Mul.

Brachyacantha 10-Punctata Melsh.

Azya pontibrianti preys on *Saissetia hemipherica. Targ* and also *Saissetia oleae Bern* while *Hyperaspis trilineata.* destroys the Sugar Cane Mealy Bug (Ripersia sp.) *Brachyacavtha* ***10-punctata*** is predaceous on Pseudococcus. sp.

NOTES ON TICKS.

A collection of ticks principally from the coast-lands of British Guiana was recently forwarded to the Imperial Bureau of Entomology for an examination which was performed by Messrs. Nuttall and Warburton of Cambridge University. Below is given a list of their identifications together with the hosts.—

Rhipicephalus sanguineus. Latr. This species (A male and female in coitû) was taken from inside a dog's ear.

Margaropus annulatus. var. *australis.* Fuller.—Numerous specimens were collected on cattle. The species occurs commonly in all parts of the colony.

Amblyomma cayennense. F.—This species attacks man in the upper parts of the Canje Creek, Berbice.

Amblyomma humerale. Koch.—This species was collected from the head of a turtle in Berbice.

Amblyomma dissimile. Koch.—This is a common occuring species on the Crapeau (Bufo marinus) and several species of snakes.

Bees and Scrap Rubber.

In the course of rubber tapping experiments carried out at Onderneeming two species of small bees were observed to be diligently carrying off the scrap rubber from the trees, quite appreciable losses being thus sustained. Mr S. H. Bayley the Superintendent, forwarded specimens which were sent to the Imperial Bureau of Entomology for identification. The two species concerned proved to be *Melipona amalthea.* F. and ***Melipona pallida. Latr.***

Sugar Cane Termites.

AN examination of large numbers of termites taken from the cane-fields of this colony show that two distinct species are present.

These have been recently determined by Baron von Rosen through the agency of the Imperial Bureau of Entomology.

The most commonly occuring species on every sugar estate is *Eutermes costaricensis Holmgr.* and the second species, which is uncommon is *Mirotermes nigritus. Lilv.* This latter species constructs a nest the greater part of which is beneath the soil and its substance is very much harder and darker in colour than that constructed by *Eutermes costaricensis.*

Talc as a Renovator of Damaged Rice.

The Editor of the Queensland Agricultural Journal (August, 1913) mentions the fact that powdered talc, is used in the renovation of damaged rice. Old, discoloured, worm-eaten rice is said to be so treated that it takes on the appearance of new grain, which is said to be very injurious to native labourers in tropical countries where rice is the staple food.

—Tropical Agriculturist, February, 1914.

Hints, Scientific and Practical.

Sanitation in Southern Nigeria.

In Southern Nigeria in 1912 there were nearly 200,000 house-to-house inspections, and the anti-mosquito work met with considerable success. Summonses were taken out in 2,516 instances, and in Lagos the number became at one time so great as to exceed the powers of the Court to deal with them. Reclamation has been carried on with good results at Lagos, Forcados, Burutu, Bonny, Calabar and other places. In Lagos Island considerable areas of insanitary ground have been raised by means of ashes from rubbish kilns, the foreshores on the north side have been greatly improved, and owners of land behind them are expending money to raise their property to a suitable level as they see that the result of their outlay will now be permanent.

It is hoped that early this year a pipe-house supply in Lagos will be an accomplished fact. The question of drainage will then have to be met in a more energetic manner.

—"The Colonial Journal."

Vaccine Lymph.

In view of the difficulty of keeping lymph active during long voyages the preparation of it in the Accra Laboratory is of general interest.

A Hausa butcher in the town provides a reliable weekly supply of calves at the rate of 15s. After the lymph has been collected, the animal is slaughtered and examined. There is a well-built calf-shed in connection with the Laboratory, the floor and wall are of smooth concrete and all corners are rounded. The walls are breast high and the roof is supported on pillars. The four stalls at one end for calves are separated from the wall by a passage way, and there is a hinged table and other apparatus at the other end, on which the calf is strapped. When the animal arrives it is put on the table and the temperature is taken per rectum. The skin is cleared of ticks and a blood smear is examined. Everything being satisfactory, the chest, abdomen, and thighs are well scrubbed with carbolic soap and water. The parts are then shaved and again washed with sterile water. Thereafter, scarifications in parallel lines are made and the lymph well rubbed in. Prefer-

ence is given to calves with a soft, white skin, and males are chosen because of the fine result of inoculation of the scrotum. The usual age of the animal is between five and eight months.

After an interval of seventy-two hours, the vesicles are scraped and the material so collected is weighed.

Four times the weight, of equal parts of glycerine and water, previously sterilised, are added, and the whole is ground in the Chalyban's machine, to a fine cream.

The prepared lymph is stored in the ice chest. A guinea-pig is inoculated subcutaneously, and both aerobic and anærobic cultures are made at intervals. For distribution the vaccine lymph is put up in tubes sufficient for 100, 200, or 500 insertions. The cork is sealed with paraffin, and they are packed in wooden boxes, and despatched by registered post. A sufficient supply for emergencies is always kept on hand.

The lymph is despatched so as to reach its destination by the end of the fourth week, thus allowing time for its use to be countermanded if contamination is discovered.

In 1912 primary cases of vaccination from this lymph numbered 2,378 with 87.94 per cent. successes, but if the cases are excluded when the lymph used was over three months old, this percentage rises to 94.98.

"The Colonial Journal."

The West African Oil Palm.

"The full grown oil palm may attain a height of about sixty feet, and consists of a stem covered throughout its length with the bases of dead leaves, and bearing at the apex a crown of large, pinnate leaves each of which may be fifteen feet in length. The fruits are borne in large bunches termed "heads" or "hands," which are small and numerous when the tree first begins to bear but decrease in number and increase in size in the next few years; as many as thirty "heads" may be formed at first, decreasing to anything between two and twelve as the tree ages. The fruits are usually from one to one and a half inches in length, and three quarters to one inch in diameter and are roughly egg-shaped. The fruits are reddish brown

or orange in tint. The fruit is botanically a drupe and consists of three well-marked portions. Outside is a layer varying in thickness and composed of a soft fibrous pulp, carrying from fifty-five to sixty-five per cent. of an orange coloured, semi-solid fat, which when extracted constitutes the palm oil of commerce. Inside this pulp is the palm nut, consisting of a hard woody shell, which may vary considerably in thickness, enclosing usually a single palm kernel, though sometimes two are even present; the kernel is the second useful product of the palm fruit; it is dark reddish brown or almost black externally, and internally consists of a rather hard, white "flesh" loaded with oil, which when extracted constitutes the "Palm-Kernel oil" of commerce. The tree is very slow growing, and it is estimated that it attains its full height of sixty feet in about one hundred and twenty years." The oil palm is propagated from seed, only seed from eight to ten years old trees and upwards should be used for planting purposes as those from young trees are extremely small and in all probability would not give as good results as seed from mature trees.

The nursery beds should be raised, made of fairly rich humus soil and near a watercourse if possible to ensure the proper humidity of the soil. The seed should be planted about eighteen inches apart each way at a depth of from one to one and a half inches. The seed is said to take from four to five weeks to germinate but I find in this country they may take as long as three months. The beds require to be artificially shaded and in dry weather regularly watered. When the seedlings are a foot high they may be transplanted into their permanent quarters which should be about 25 feet apart. Holing similar to that of planting rubber is greatly beneficial.

Palm Oil cultivation would lend itself well to a catch crop such as coffee as the palms give little shade until they are from six to eight years old, and then probably not too dense to interfere with the growth of catch crops.

—F.M.S. "Agricultural Bulletin."

Tropical Agriculture Congress.

The International Association for Tropical Agriculture (Association scientifique internationale d'Agronomie coloniale et tropicale) has decided to hold in London, June, 1914, an International Congress, in which all countries interested in Tropical Agriculture and Forestry are invited to participate. The Association has requested the Committee of the British Section whose headquarters are at the Imperial Institute, to make the necessary arrangements for the meeting, in co-operation with the Bureau of the International Association in Paris.

The Congress will be held at the Imperial Institute, South Kensington, London, S.W. It will open on Tuesday, June 23rd, and close on Tuesday, June 30th, 1914.

Communications intended for the Congress may be made in English, French, German or Italian; but the general language of the Congress will be English.

The following subjects are suggested for papers and discussion at the morning meetings. Contributions on these and similar subjects are invited.

I. Technical Education and research in Tropical Agriculture.

II. Labour Organisation and Supply in Tropical Countries.

III. Scientific Problems of Rubber Production.

IV. Methods of developing Cotton Cultivation in New Countries.

V. Problems of Fibre Production.

VI. Agricultural Credit Banks.

VII. Agriculture in Arid Regions.

VIII. Problems in Tropical Hygiene and Preventive Medicine.

Papers for the afternoon meetings are invited on the following subjects:—

I. Problems relating to Tropical Agriculture and Forestry.

II. The Cultivation and Production of—

Rubber	...	...	Tea
Cotton and Fibres		...	Coconuts
Cereals and other Foodstuffs.		Other Agricultural Products.	
Tobacco.	...	...	Forest Products.

III. Plant Diseases and Pests affecting Tropical Argiculture.

Papers recommended for publication and reports of Discussions will be published at the close of the Congress.

The subscription for membership of the Congress will be £1.

Protecting Iron with Paint.

The paint bill is a serious item with many colonies, which are therefore interested in certain experiments made by the German chemists, Liebriech and Spitzer. They have come to the conclusion that a single coat of paint affords a better protection against rust than two or more coats. This result is explained that one coat is more elastic and less liable to scale off or crack than a double coat. The two coats do not combine altogether with one body, and it is conceivable that one interferes to some extent with the other.

—The Colonial Office Journal.

Sugar Beet.

The production in Austria, Hungary (proper), Prussia, Belgium, Denmark Spain, France, Italy, Netherlands, Rumania, Russia in Europe (63 Governmenrs), Switzerland, Canada and United States is estimated at 55,969,000 tons, as compared with 55,714,000 tons in 1912, the increase being equal to 0.5 per cent.

—Journal of the Board of Agriculture of England, Feb., 1914.

The Model Gardens.

Record of Attendances.

Below is given a table, arranged in quarterly periods setting out the number of pupils who attended the Model Gardens of the colony from April 1, 1907. These quarters (recorded below as 1st, 2nd, 3rd and 4th) run from January 1 to December 31. The totals only during 1907, 1908 and 1909 are given; the records since then are in detail.

Quarters.	Bourda.	Charlestown.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	La Grange, W. Bank, Dem.	Suddie, Essequibo.	Den Amstel.	Houston, E. B.	Wakenaam.	Total Attendances.
1908.										
1st–4th	5,447	3,386	1,477	887	1.053	160	...	...	...	12,410
1909.										
1st–4th	6,473	2,665	1,738	1,277	1,192	1,897	662‖	...	...	16,904
1910.										
First	1,282	769	287	370	259	489	465	..	...	3,921
Second	1,311	558	787	894	303	455	519	403§	...	5,240
Third	¶1,234	526	910	748	294	510	498	537	...	5,257
Fourth	1,209	444	1,285	336	295	493	502	592	...	5,156
1911.										
First	1,086	360	1,042	838	312	514	414	572	577	5,695
Second	1,263	326	713	816	286	292	536	591	688	5,511
Third	¶ 1,093	385	910	627	361	297	543	441	639	5,296
Fourth	1,687	448	935	588	447	406	737	957	540	6,745
1912.										
First	1,127	379	1,374	1,034	425	207	573	359	423	5,901
Second	1,385	359	1,096	900	484	553	730	461	413	6,381
Third	1,416	400	763	889	412	572	621	616	443	6,132
Fourth	1,586	254	1,162	479	459	768	620	720	439	6,487
1913.										
First	1,613	464	1,060	637	529	764	661	464	342	6,534
Second	1,273	498	1,368	863	517	766	653	508	401	6,847
Third	1,176	495	904	670	498	945	736	475	333	6,232
Fourth	1,094	505	1,203	349	451	924	518	389	243	5,576
1914.										
First	1,134	481	1,245	624	564	1,014	475	498	370	6,405

Note.—The figures for the Country Model Gardens quoted above refer only to the numbers present during instruction given by the Superintendent Teacher. It has not yet been found feasible to keep reliable, full records of the very numerous attendances during his absence

¶ Schools in vacation during August.

‖ Instruction commenced in July.

§ Instruction commenced in April.

Exports of Agricultural and Forest Products.

Below will be found a list of the Agricultural and Forest products of the colony exported this year up to March 30th, 1914. The corresponding figures for the three previous years are added for convenience of comparison :—

Product.	1911.	1912.	1913.	1914.
Sugar, tons ...	13,866	15,252	13,855	17,470
Rum, gallons ...	331,639	902,210	942,333	993,903
Molasses, casks ...	179	650	505	gallons. 62,799
Cattle-food, tons ...	2,020	1,566	2,830	765
Cacao, cwts. ...	59	.5	...	209
Citrate of Lime cwts.	...	...	...	...
Coconuts, thousands	216	716.5	263	579
Copra, cwts. ...	425	710	329	490
Coffee, cwts. ...	269	469	509	927
Cotton, lbs. ...	...	...	...	...
Fruit, brls. and crates	...	...	...	...
Ground Provisions. va/ue	..	..	...	...
Kola-nuts, cwts. ..	...	...	...	...
Rice, tons ...	701	1,136	1,181	2,921
Rice-meal, tons ...	124	531	705	98
Cattle, head ...	181	141	177	370
Hides, No. ...	1,414	722	1,549	1,738
Pigs, No. ...	196	242	544	360
Poultry, value ...	...	...	...	...
Sheep, head ...	18	6	4	6
Balata, cwts. ...	647	212	1,928	2,078
Charcoal, bags ...	17,778	18,544	14,809	22,076
Firewood, Wallaba, etc., tons ...	2,557	2,817	2,191	32,15
Gums, lbs. ...	787	446	1,332	...
Lumber, feet ...	104,321	46,073	66,611	120,190
Railway Sleepers, No.	1,000	1,556	1,503	502
Rubber, cwts. ...	4	1	4	...
Shingles, thousands	929	207.5	703	254
Timber, cubic feet	58,096	63,286	124,038	73,184

INDEX TO VOL. VII.

1913—'14.

A.

B.

C.

C.—(Continued).

D.

E.

F.

G.

H.

I.

L.

M.

M.—(Continued).

N.

O.

O.—(Continued).

P.

P.—(Continued).

R.

S.

S.—(Continued).

T.

U.

V.

W.

X.

Y.